Annual Report 1982

Salmonid Enhancement Program

Government of Canada
Fisheries and Oceans

Gouvernement du Canada
Pêches et Océans

Province of British Columbia
Ministry of Environment

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Director's Report

One of the most rewarding aspects of 1982 is that the early years of enhancement started to provide benefits through fish production. This year was the sixth of the seven-year Phase I of the Salmonid Enhancement Program (SEP).

Fish production

Adult fish from SEP facilities are appearing in the commercial, sport and native food fisheries in increasing numbers. Preliminary analyses from coded-wire tag and fin-clip recoveries, fishway installations, and lake enrichment projects, indicate that projects undertaken since 1977 have contributed a total 1,180,000 adults to the Canadian commercial and sport fisheries from 1977 to 1982 inclusive. The salmonid returns have changed incrementally each year and thus indicate that additional benefits will be forthcoming when our program reaches operating capacity next year. Our major producer has been lake enrichment (for sockeye), followed by coho and chinook production from hatchery facilities.

Facilities built prior to SEP, many operating at full capacity, added another 2,730,600 salmonids of all species to the Canadian commercial and sport fisheries over the 1975 - 1982 catch years.

Major construction is drawing to a close. Kitimat hatchery, the most complex hatchery to be built during SEP, is nearing completion. Tenderfoot hatchery was expanded in 1982, and the $6.7 million Chehalis hatchery was completed in time for the fall egg-take.

The Job Creation program, initiated in June 1982, caused us to scramble to bring on-line several short-term projects we had on the drawing board. In all, 120 projects were completed by the end of March 1983. These projects not only created employment, they also were valuable to the Program, which would not have undertaken them without this extra funding.

Planning

One of SEP's major strengths is its planning capability, and this was rigorously tested throughout 1982. A tremendous amount of time was spent planning, which led to several alternatives for the future of SEP. These were presented to the federal government in early 1983.

The report of the Pearse Commission on Pacific Fisheries Policy was released in September 1982. Dr. Pearse supported the Program, and also made several recommendations. Some of the key recommendations were: that SEP should ensure that enhancement efforts were better integrated with overall fisheries management objectives; that more complete evaluation of SEP projects should precede further investment; and that the socially-oriented aspects of the Program should continue. The impact of these recommendations is seen in the Transition Plan.

This year really was a pivotal one for the Salmonid Enhancement Program. We were nearing the end of Phase I, planning the Transition Phase and Phase II. At the same time, three key players in the formation and direction of SEP--the former Minister of Fisheries and Oceans Roméo LeBlanc; Deputy Minister, Don Tansley; Assistant Deputy Minister, Doug Johnston--retired or were reassigned. The new team will undoubtedly make its mark in shaping the future of the Program.

Advice helps

Two valuable advisory groups will help in this process: the Salmonid Enhancement Board and the Salmonid Enhancement Task Group. The Board is the primary advisory body for SEP. Composed of a majority of private sector members and a minority of government members, it is chaired by the Deputy Minister and advises the Minister of Fisheries and Oceans on SEP. The Task Group, in turn, advises the Board. It is composed entirely of representatives of various user and interest groups from around the province. This 19-member body conveys to the Board the public's wishes about the Program.

Jobs

Phase I also has significant impacts on job creation and employment. About 8,900 person-years of employment will be created over a 30-year period from 1977 in the construction, operation, and maintenance of SEP facilities. And for every job created on enhancement projects, three or more are created in the fishing industry. Indirectly attributable to SEP is the employment created in industries that supply goods and services to SEP projects and to commercial fishermen and processors. The spending of incomes earned in both direct and indirect SEP-related employment will stimulate further economic activity and job creation.

Benefits to native people

SEP benefits native Indians in B.C. in several ways. Enhanced salmon production generates additional income and employment for native Indians in the commercial harvesting and processing sectors. The Community Economic Development Program creates full-time permanent employment in small projects that are built, operated, and managed by native people. SEP production also contributes significantly to the improvement of catches in the native food fishery.

Matching Performance with Goals

Next year, 1983, is the last year of Phase I. In 1983 and in the following two years, called the Transition Phase, we will be working hard to secure the future of SEP.

One of the important goals established for SEP was to contribute to the economic well-being of society. This is measured by determining if the benefits to society exceed the costs of the Program. It turns out that Phase I of SEP has been highly successful, especially when account is taken of the erosion of its financial base by inflation and the extension of its term by two years without additional funding. Appendix B shows SEP expenditures by program area.

Significant production capacity has already been completed, and it is projected that 85 percent of target capacity will be achieved by the completion of Phase I. With a benefit/cost ratio of 1.4:1, the Program has produced over $130 million of net economic benefits, 40 percent greater than the costs of the Program to date. In addition, the distribution of enhancement activities has been such that almost $100 million of direct incomes have been generated in the less-developed regions of the province.

Regional development

The Regional Development account was established to measure the benefits from enhancement in areas outside the Lower Mainland and southern Vancouver Island. The goal was to provide $200 million in benefits to these target areas. Based on projections of total catch from Phase I production and its distribution by gear type and processing region, benefits accruing to the less developed regions are estimated to be approximately $99.1 million. This represents about 50 percent of the goal established for Phase I, which isn't too bad, considering that, because of inflation, SEP received only 52 percent of the funding level upon which the original target was based.

The $99.1 million in benefits is comprised of fishing income, workers' wages in the processing sector, net corporate income, and operations and maintenance wages.

Native people

The commercial fishing industry is the most important source of income and employment for B.C. Indian people, and any program designed to strengthen this industry will have significant positive impacts upon native people. Salmonids are also an important source of food for B.C. Indians and have contributed significantly to the social and cultural tradition of these people.

Total native employment in the harvesting sector due to increased fish production is projected to be 55 person-years in the peak year, 1995, at which time 96 person-years of employment will be generated in the processing sector.

Phase I of SEP not only generates income and employment for native people in the harvesting and processing sectors, it also means direct employment in the construction and operation of SEP facilities.

To date, native involvement in the construction and operation of large scale facilities has been minimal due to several factors. First, almost all of SEP's construction activity is done under a competitive bidding process, with the contract awarded to the lowest bidder. The successful contractors have not employed significant numbers of native people. Secondly, native employment in government has been hampered by hiring regulations and the competitive bidding process, which stipulate that current employees be given the first opportunity for government jobs.

To overcome some of these difficulties, twenty-two affirmative action projects have been launched. In most cases, the projects are initiated and managed by native people. Funding comes from SEP and other federal government agencies. Taken together, the program, called the Community Economic Development Program (CEDP) has proven to be a highly successful native economic development program.

An assessment of CEDP by A.D. Rank states that for the period 1977 to 1982, CEDP generated employment totalling 266 person-years (85 percent of all of SEP's contract employment) for native Indians. The majority of this employment consists of continuing, full-time jobs. With unemployment among the native bands ranging from 40 percent to 80 percent, this program generates a high proportion of net new employment.

Employment

Employment attributable to SEP includes construction and operation of enhancement facilities, employment generated in the harvesting sector and incremental employment in the processing sector.

SEP should generate abut 29,000 person-years of employment over a 30-year period. About 8,900 of those will be related to the construction, operation and maintenance of SEP facilities. Another 11,700 will be found in the harvesting sector and the remaining 8,400 in processing the enhanced catch. Looked at another way, for every job created directly on enhancement projects, three jobs are created in the fishing industry.

Environmental preservation

The investment in SEP shows the federal commitment to the preservation of salmonid stocks and their habitats.

This commitment is visible in habitat improvement projects, restoration of local streams and improvement of small local salmonid stocks. In addition, major capital projects have been designed to complement the natural environment and to assist small, ecologically important stocks as well as the larger, economically viable ones.

Fish production

An enduring base for the enhancement of Pacific salmonids has been established. SEP now has a solid network of enhancement facilities, plus a large pool of alternate enhancement techniques, public involvement and enhancement opportunities. By March 1983, completed facilities and existing enhancement projects, including lake enrichment, side channel development, fishways and small projects, had the potential, when operating at capacity, to contribute 39.5 million pounds (17.9 million kilograms) to the Canadian catch (Appendix A). Current estimates for total annual production of the completed Phase I program are approximately 43 million pounds (19.5 million kilograms).

The dynamic nature of the enhancement process is reflected in Appendix A which shows that some fish production targets have been exceeded while others have not been met.

Expectations for sockeye and steelhead have doubled due to the success of lake enrichment and steelhead fry stocking programs. Targets for the other species are reduced, largely due to inflated costs affecting conventional hatchery enhancement techniques.

The variables which affect SEP's fish production are found both within and outside the Program. In lake enrichment, for example, the network of lakes undergoing treatment varies from year to year. On a departmental level, the priorities of fisheries management come into play. Adjustments in production levels and species balance are made in response to mixed stock harvesting problems. Special emphasis has been placed on chinook conservation and enhancement. International agreements and interceptions are taken into consideration.

The areas of community economic development and public participation have had more flexible operational plans.

Each summer, SEP undertakes a rigorous review and planning process. Strategies, both immediate and future, are established for each project. Several factors are considered: intra- and interspecies interaction, preservation of unique stocks through techniques like satelliting and strategies related to water quality, fish health, rearing and time-of-release. As well, the accumulating evidence of hatchery returns and experience from pilot facilities aid in the planning process.

All plans approved by enhancement and fisheries management staff are analysed to forecast the catch in the Canadian commercial, sport and native food fisheries.

SEP is a very complex program because it involves not only biological and technical factors, but social and economic ones. In short, SEP uses the vehicle of fish production to produce economic and social benefits for the people of Canada. SEP's achievement will be measured in terms of those benefits.

Going into the last year of Phase I of SEP, I would like to extend my thanks to all the members of the SEP team--federal and provincial SEP staff, the thousands of volunteers and our contractors--for their efforts in making this program the success it is.

N.W. Falkner, Ph.D.
Director, SEP

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South Coast

1. *A very successful fishery for children was held in Vancouver's False Creek. The pan-size chinook were raised by BCIT students under contract to SEP.*
2. *Volunteer projects receive technical advice as well as a helping hand from community advisors.*
3. *Heavy riprap for a protecting dike was stockpiled at the site of the Glendale River project.*

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South Coast (Mainland)

Capilano Hatchery

Capilano hatchery is situated in scenic Capilano Canyon Park in North Vancouver, immediately below Cleveland Dam, approximately five kilometres upstream of the mouth of the Capilano River.

Hatchery Capacity and Facilities

Constructed in 1971 the hatchery was designed to produce one million juvenile coho, 350,000 chinook and up to 65,000 steelhead trout. Subsequent modifications have increased the capacity to produce an additional 1.5 million juvenile chinook annually. Adult fish handling facilities at the hatchery include a river barrier, fishways, a trapping and brailing system, two Burrows-type adult holding/juvenile rearing ponds, and two circular fiberglass tubs. Juvenile facilities include 10 standard Burrows ponds and thirty rearing troughs. Incubation facilities include Heath tray stacks and freestyle boxes.

Current modifications to the hatchery include renovations to the filter chambers below the rearing ponds, for utilization as additional fish rearing areas. When completed these renovations will provide accommodation for an additional one million fish, as well as additional area for research activities. The ability to extend the rearing of steelhead trout to two years is also provided by these modifications.

A pipeline from Capilano Lake supplies the hatchery with surface water. In addition, groundwater is provided from a network of underground tunnels in the vicinity of the east end of the Cleveland Dam. This groundwater can be heated to a temperature in excess of 20°C for the manipulation of egg development during incubation and the provision of the most ideal conditions for the initial rearing of newly-hatched fry. Considering Capilano River water is generally very cold, this heated groundwater is a most valuable asset.

The hatchery complex also provides offices, laboratories, workshop and research facilities. A standby generator and public display area are also provided.

Operations

During 1982, the hatchery released one million chinook smolts and 550,000 coho smolts into the Capilano River. An additional 890,000 coho fry were released in the upper Capilano watershed. The 1981 brood steelhead were retained for an additional year of rearing and will be released in 1983.

The entire fry production from 1981 brood chinook were involved in an initial time-of-release study. In another study, marked coho fry were released above and below Cleveland Dam to assess the rearing capacity of the two areas as well as the relative success of smolt migration over the dam. Over 750,000 additional coho fry were released in the upper watershed for utilization of that rearing area.

The fry from the 1980 brood coho were involved in two major research studies: the repeat of a size-and-time-of-release study conducted in cooperation with the Fisheries Research Branch in Nanaimo, and the effects of grading on juvenile coho during early rearing. Assessment of the survival, distribution and contribution from the sterilization study of the 1978 brood coho is continuing.

Other research activities in 1982 included the repeat of the sterilization work, initiation of two-year rearing of steelhead and the assessment of the degree of bird predation on hatchery stocks during rearing. In addition, further experimentation in the areas of egg disinfection and disease transmission; for example, bacterial kidney disease from adult to egg to fry, were carried out. A variety of experiments to improve fish culture techniques were also undertaken.

Results of the current hatchery production strategies are evident by the increasing size of the sport fishing fleet at the mouth of the river in the late summer, the obvious increase in the activity and success rate of the native food fishery and an increase in escapement back to the hatchery. In 1982 more than 27,000 coho returned to the hatchery and an estimated 10,000 were taken in the native food fishery and sport fisheries combined.

Tourist Attraction

Capilano hatchery continues to be a favorite attraction for local visitors as well as for tourists from all over the world; over 300,000 people passed through in 1982. Attractions include live fish in various stages of development, written material and displays.

Contact: Eldon Stone, Stock Enhancement Officer; Colin MacKinnon, Unit Head, Enhancement Operations; John Beyer, Senior Engineering Technician, Engineering.

Seymour River Hatchery (BCIT)

The Seymour River hatchery is located immediately below the Rice Lake Dam in North Vancouver. The B.C. Institute of Technology, under contract with SEP, operates the hatchery as a training facility. BCIT fisheries program students receive hands-on experience in fish culture and enhancement techniques; the species they work with are chinook, coho, steelhead, and cutthroat.

In 1982, students coded-wire tagged a number of broods of summer and winter-run steelhead, coho, and cutthroat prior to their release into the Seymour River. Sport anglers in the area are expected to benefit from the increased salmonid production. Coho and cutthroat were provided to the False Creek sea pen project for various studies conducted by BCIT students at that location.

The hatchery will continue to be a production/education facility in 1983. Two people are employed at the hatchery.

Contact: Chris de Hrussoczy-Wirth, Project Coordinator, Special Projects Division.

False Creek Sea Pens (BCIT)

This project, located in Alder Bay on Vancouver's Granville Island, provides BCIT students experience in rearing chinook in sea pens and in conducting related experiments. The project is operated, under contract to SEP, by the B.C. Institute of Technology. It employs one person.

In 1982, the students released 7,000 chinook (1980 Capilano brood) for the third annual children's fishery at False Creek. Held over three days in May, the fishery attracted approximately 10,000 people. Several themes were developed to make the event fun and educational for young anglers and the adult onlookers: salmon and commercial fishing; salmon as a sport fish; salmon and culture; and salmon as food. SEP Executive Director Ward Falkner presented special community service awards to several individuals and groups engaged in volunteer salmonid enhancement projects throughout the province.

In the fall, 16,500 Capilano hatchery chinook (1981 brood) were transferred to the sea pens for rearing. Also 2,000 cutthroat (1982 brood) and 2,700 coho (1981 brood) from Seymour River hatchery were brought in for feeding experiments.

BCIT students and their potential employers both profit from the opportunity for hands-on experience in addition to the theory taught in the classroom and laboratory.

Contact: Chris de Hrussoczy-Wirth,
Project Coordinator, Special
Projects Division.

Indian River Feasibility

Work continued on determining the feasibility of establishing a multi-species hatchery complex on Indian River. The final results of well-testing undertaken in December 1982 were discouraging. Samples of both ground and surface water in this watershed have been plagued by low pH, low hardness, and high levels of various metals, including iron, zinc, mercury, and copper. Considering the marginal water quality, together with the related fish-culture problems reported for the 1979/80 pilot operation, and with the presence of other facilities in Burrard Inlet that could be expanded to satellite fry into the Indian River, it has been recommended that this site be rejected for major production purposes.

Contact: Bruce Shepherd, New Projects
Coordinator, Enhancement
Operations; Otto Rapp, Senior
Project Engineer,
Engineering.

Tenderfoot Creek Hatchery

The Tenderfoot Creek pilot facility commenced full operation in July 1982. The hatchery is located approximately 16 kilometres north of Squamish, on Tenderfoot Lake. Initial production targets for the hatchery are 188,000 juvenile chinook, 60,000 coho, and 102,000 steelhead.

The hatchery was operated on a temporary basis in the spring of 1982. Nearly 96,000 chinook fry (1981 brood) which had been incubated and initially reared at Capilano hatchery were reared for two weeks at the Tenderfoot facility before being released into Tenderfoot Lake on April 29.

The 1982 chinook brood capture was accomplished primarily by gillnetting, supplemented by angling. Stocks come from Ashlu River, Squamish River and tributaries, Mamquam River, and Cheakamus River. The fish were transported back to the hatchery site, held until ripe and then spawned.

All stocks are kept separate throughout the entire process, from adult capture to fry release. Due to low escapement and time/distance constraints the total chinook egg target (232,000) was not reached (180,000 eggs were collected), and the Mamquam River element was dropped.

Resulting fry will be returned to their native river in the spring of 1983. An extensive coded-wire tagging program will be undertaken to evaluate imprinting and time of release.

The coho program is also designed as a satellite operation with stocks coming from Squamish River and tributaries, Ashlu River, Mamquam River and Tenderfoot Creek. For this first year of operation the Mamquam and Ashlu Rivers were not utilized for brood stock.

A semi-permanent trapping/holding structure was installed on Tenderfoot

Creek to facilitate the capture of adult coho. Squamish River brood stock was captured by gillnetting and electrofishing and was handled in a similar manner to chinook. Coho egg targets were surpassed, with 264,000 eggs taken.

The steelhead program is scheduled to commence in the late spring of 1983. Presently, the target is for 140,000 eggs, 70,000 each for the Cheakamus River and Squamish River. All adult capture is to be done by angling; the fish will be transported to the hatchery, held until ripe, airspawned, and returned to their native stream.

Contact: Bill Foye, Stock Enhancement Officer; Dave Celli, Assistant Stock Enhancement Officer, Enhancement Operations.

Sechelt Community Development Project

The Sechelt Indian Band operates this project in Porpoise Bay, near the village of Sechelt. The objective of the project is to enhance the local coho and chinook sport, commercial and native food fisheries in Sechelt Inlet and to increase chum stocks in local streams.

In 1982, four Band members were employed full-time at the sea pen facility and the pilot incubation sites. They also upgraded their fish culture and management skills through specialized courses offered through Malaspina College and the Community Development Unit of SEP's Special Projects Division.

Approximately 10,000 chinook (1980 brood) and 20,000 coho (1981 brood) from Capilano hatchery stock were reared in the sea pens until their release in June at an average weight of 146 grams for chinook and 40 grams for coho.

In the fall, staff collected 2,000 chinook eggs and 72,000 chum eggs from local brood stock. They also collected 5,000 coho eggs from tagged returning adults to the sea pens. The eggs were planted in nearby pilot incubation facilities.

Construction began on a small incubation facility on a piece of reserve land adjacent to the sea pens. An intake was built on Shannon Creek (Walkers Brook) and a pipeline laid overland and sunk in Porpoise Bay to supply water to the new site. Plumbing, four Capilano-style rearing troughs and two fiberglass rearing tubs were set up.

In 1983, more chinook and coho will be reared and released at the sea pen facility. Chum fry from the 1982 brood will be released in local streams and more chum, coho, and chinook eggs will be collected. A hatchery building, complete with hydro and telephone, will be constructed at the Shannon Creek site.

Contact: Maurice Boisvert, Project Coordinator, Community Development Unit, Special Projects Division.

Powell River Salmon Society

In late 1982, several residents of Powell River formed a society to develop a hatchery facility for coho on Lang Creek, approximately 0.8 km below the outlet of Duck Lake.

This project is funded through the Government of Canada Special Employment Initiative Program and meets the main criterion for selection under this program; it is an attractive employment creation opportunity. Plans are to enhance natural runs of coho (and possibly chinook and steelhead in the future) to historic levels, improve sport fishing in the area, and develop and promote public awareness for the program and the salmon resource.

Four full-time staff will be hired in 1983. They will attend courses in fish culture and management techniques offered through Malaspina College in Nanaimo and Terrace. As well, they will identify stream enhancement opportunities; rehabilitate some streams through such techniques as gabion placement; identify a site for the development of a small hatchery facility; monitor temperature, pH, flows and water levels of five creeks in the area; collect 100,000 coho eggs (later to be expanded to 200,000) to operate a small satellite facility; construct intake, pipeline, building, troughs, etc., as part of the hatchery implementation plan; and explore other areas which could benefit from stream improvements.

Contact: Maurice Boisvert, Project Coordinator, Community Development Unit, Special Projects Division.

Sliammon Hatchery

Five members of the Sliammon Indian Band have operated this Japanese-style hatchery since 1977. Located on the Sliammon River, eight kilometres north of Powell River, the project is designed to enhance existing stocks of chum and coho in the Sliammon River and to train and employ selected Band members in fish culture and management.

In 1982, hatchery staff released approximately 990,000 chum fry (average size, one gram) and 4,800 coho from the 1981 brood (average size, 5.9 grams) into Sliammon River. Unfortunately, 11,900 rearing coho from 1980 brood stock were killed when the water supply was shut off by vandals.

Staff constructed a river intake and pipeline to supply water to the new concrete adult holding and rearing ponds; placed security fencing around coho rearing ponds; modified and repaired the standby pump and intake; modified the fence and rearing pond outlet; recovered tags from returning adult chum and coho; enumerated downstream migration of juvenile chum and coho; collected 1.5 million chum eggs and 34,000 coho eggs; and attended 11 training courses offered through Malaspina College.

In 1983, the 1982 brood chum salmon will be released and the coho will be reared until their release in Sliammon Lake in early 1984. Both enumeration of downstream juvenile migrants and recovery of tags from returning adults will continue. Targets for egg-takes in 1983 are 1.5 million chum eggs and 100,000 coho eggs from Sliammon River and 50,000 coho eggs from Okeover River. An auxiliary water supply line will be installed for the coho rearing pools. Banks will be stabilized and boulders placed in Sliammon channel below the new river intake. General landscaping and road improvement will be undertaken at the hatchery site.

The Band hopes to establish a sea pen facility in Okeover Inlet in a couple of years. They will be collecting data during 1983 to determine the feasibility of such a project.

Contact: Maurice Boisvert, Project Coordinator, Community Development Unit, Special Projects Division.

Vancouver Bay Project

The Vancouver Bay project is a SEP/B.C. Forest Products hatchery on Jitko Creek, a tributary of Vancouver River. It is designed to enhance local chum and pink stocks as well as produce small numbers of coho and steelhead.

In 1982, approximately 1.3 million pink fry and 150,000 chum fry were released. Due to a low adult chum return to Saltery Bay Creek, no chum eggs were taken from this stock; however, 17,500 chum eggs were collected from Jitko Creek. Thirty thousand coho eggs were obtained from Vancouver River stock; the resulting fry will be raised to five-gram size before releasing them in the headwaters of Vancouver River. No pink salmon eggs were collected in 1982 since the run occurs only in odd years.

Plans are underway to incubate steelhead eggs in 1983.

Contact: Kim West, Biologist, Special
Projects Division.

Glendale River Project

This project is located on the south shore of Knight Inlet, near Glendale Cove, approximately 75 km by air north of Campbell River.

A major spawning channel for pink salmon production (1 million per year) is proposed for this site.

An important part of any spawning channel is bank protection. Rock has been found to be the best material to stabilize the sloping channel sides which are subject to eroding forces by the action of both water and spawning fish. In addition, larger rock is always required as a facing material on the outside of dikes. Since the Glendale site is flood prone, a substantial dike, complete with heavy riprap protection, is planned at the river's edge.

In 1982, both sizes of rock, channel lining (30 cm diameter) and heavy riprap (90 cm diameter) were produced and stockpiled in the immediate vicinity of the proposed construction by the rock contractor. Difficult weather conditions during the winter months, plus active logging operations in the vicinity created substantial delays in completion of this work.

The spawning channel site was logged in 1981 and early 1982. This, coupled with the very high runoff, meant that adequate site drainage was a necessity. A large drainage ditch was therefore constructed from the base of the cliffs on the east side of the site to the Glendale River on the north. Three large settling basins along the length of the ditch ensure that siltation of the river is minimized.

Construction work at this site was halted in April 1982 due to fiscal restraints. Contracts that were underway at that time were allowed to continue to completion, but tendering on future work was cancelled. Since that time, drawings and specifications for the balance of the project have been prepared. Further discussions regarding funding are pending.

Contact: Jim Wild, Senior
Implementation Engineer;
Roy McGechaen, Senior Project
Engineer, Engineering.

Knight Inlet Reconnaissance

A consultant's report on the biophysical reconnaissance carried out during the spawning period of 1981 on the Ahnuhati, Devereux, Franklin, Glendale, Klinaklini and Kwalate systems was completed. A report on the suitability of Tom Browne Lake as a facility water supply was also produced. Because of concern as to possible heavy metals toxicity in the extremely soft water found at Glendale, a further consultant review study was commissioned to investigate this problem in relation to the use of galvanized metal in the proposed intake. A predictive equation for the leaching of zinc was produced, and it should be of general use in other feasibility studies.

When construction of the Glendale project was postponed due to funding shortfalls for Phase I of SEP, the enhancement strategy for the area was reevaluated on the basis of additional information that had come available.

It has been proposed that enhancement efforts in this area be redirected from a Glendale central facility concept, towards a complex of facilities to serve Knight Inlet. This complex would include a chinook/coho incubation and rearing facility at Devereux Creek, a pink/chum spawning channel on the Ahnuhati River, and a pink spawning channel on the Glendale River. Feasibility studies, including water quality sampling and temperature monitoring, are continuing on the Devereux and Glendale systems. It is hoped that funds will permit juvenile reconnaissance studies in the spring of 1983.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations.

Kakweiken River Survey

A consultant's report on the biophysical studies undertaken during the spawning period of 1981 has been completed. Further biobaseline studies in Thompson Sound are required before effective project planning can be undertaken. A highlight of the study was documentation of more than 500,000 pink adults passing through the fishway in 1981 (see last year's annual report).

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations.

Provincial Status Report

Lower Mainland Stream Improvement Assessment

Six stream systems were surveyed to determine the suitability of increasing trout production through habitat improvement. The stream systems studied included Alouette, Sumas, and Campbell Rivers, Hatzic Lake tributaries, McKay and Port Mann Creeks.

Fish sampling was conducted at 25 sites within the six stream systems. Streams deemed unsuitable for easy enhancement activities (due to poor access, low flows, inappropriate substrate for boulder placements, etc.) were eliminated as enhancement candidates. The remaining streams were ranked in order of their enhancement potential. They included:

- Alouette River system; Coho, McKenny, "W", and "Z" Creeks
- Campbell River
- Sumas River system; Lonzo Creek
- Hatzic Lake tributaries; Draper, Lagace, Belchorton Creeks, and the first two tributaries west of Belchorton Creek
- McKay Creek
- Port Mann Creek.

Results of this project will be used in planning future enhancement activities in these areas.

Contact: John Fee,
Fisheries Technician,
Fish and Wildlife Branch,
Victoria.

Job Creation Projects

Bowen Island Salmon Enhancement Group

Terminal Creek flows east into Deep Bay in the Queen Charlotte Channel. A nine metre falls, 100 metres from the mouth of the creek is the upstream limit of fish passage. There is potential for fry stocking upstream.

Three people constructed a small incubation and rearing facility which is used by an existing volunteer project to enhance coho runs to Terminal Creek.

An old dam was repaired to permit installation of an intake with three pipelines. The hatchery site was cleared and levelled and a small shed constructed which houses one stack of Heath trays and the water distribution system. Three rearing tubs have also been installed.

Capilano Hatchery Maintenance and Support

Four people were sponsored by the Capilano Lions Club to undertake various enhancement activities under the direction of Capilano hatchery. This extra manpower has allowed the completion of work to increase production at the hatchery. Specific projects included:

- monitoring and surveillance of the Indian food and sport fisheries
- sorting, sampling and dispensing of surplus salmon returning to the hatchery
- tag recovery from hatchery fish
- landscaping and clean-up of the hatchery site
- removal of old net pen floats from Indian Arm
- modification of a fishway
- installation of a critical high water alarm system
- installation of plumbing and a back-up generator for the sump pump.

Squamish Area Project

A crew of three people was employed to carry out enumeration of chum spawners at three improved side channel spawning areas in the Squamish region.

The crew was also involved in general construction and brood stock capture at the North Vancouver Outdoor School hatchery. In addition, the crew, working jointly with the Small Projects Unit, collected 420,000 chum eggs from fish in upper Paradise Valley spawning channel. The fertilized eggs were planted in the uppermost section of the channel. This section was separated from the remainder of the channel by a weir so that no fish could enter and spawn naturally. Results from hydraulic redd sampling of the gravel in February 1983 showed a significantly higher survival rate of eggs to the eyed stage in the hand-planted section (77 percent as opposed to 56 percent in the naturally-spawned sections).

Sunshine Coast Project

A four-man crew was hired in the Sechelt area to work closely with the local community advisor of SEP's Public Involvement Program. Work completed included the construction and repair of incubation boxes and water intakes, and fabrication of capture and holding equipment for salmon brood stock. The crew also helped with brood stock collections and egg-takes. Obstruction removal from Angus, Anderson and Chapman Creeks was also completed. One crew member was also involved in construction of the Sechelt Indian Band hatchery at Porpoise Bay.

Powell River Project

A five-man crew was hired late in 1982 to carry out stream reconnaissance for potential public participation (volunteer) projects in the Powell River area. The crew has concentrated primarily on Whittall Creek, mapping juvenile coho and trout rearing areas, adult spawning areas, and habitat problems such as stream obstructions impassable to fish. Construction of a small hatchery on Whittal Creek for 25,000 coho and 75,000 chum eggs has been initiated.

Sliammon Indian Band Project

A four-man crew was hired to remove debris from Sliammon River, Dayton, Myrtle, Whittall, Jefferd and Okeover Creeks. In addition, the crew constructed a fishway through a culvert on Whittall Creek to facilitate access of adult chum. The crew assisted the Sliammon Band's CEDP project staff during egg-takes and performed other hatchery-related tasks. This crew also carried out an extensive dead pitch (examination of all salmon carcasses) of the Sliammon River to recover marked hatchery chum.

Contact: Sam Gidora, Project
Developer, Job Creation Unit,
Special Projects Division.

Table 1

Public Participation Projects

SOUTH COAST PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1982	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1982 Releases
Richards Creek	Buntzen Bay Residents Association	6	3	incubation, feeding	coho	24,500	98	312
North Vancouver Area Creeks	Vancouver Sun/North Vancouver School District	300	2	incubation in school	coho	39,000 Transplant from Capilano hatchery.		601
McKay Creek	North Shore Fish & Game Club	20	3	stream improvement, fishways	coho	20,000	67	240
McCartney Creek	Seymour Heights Elementary/Windsor Secondary Schools	40	1	construction	coho	10,000 Transplant from Capilano hatchery.		150
Noons Creek	Brian Waite	4	4	incubation, feeding	coho	16,000	53	192
West Vancouver Area Creeks	Vancouver Sun/West Vancouver School District	200	2	incubation	coho	40,500	90	486
Cypress Creek	Hillside School Rod & Reel Club	15	3	incubation, research	coho	10,000 Reared for experimental purposes.		
Hastings Creek	Squaretailers Rod & Reel Club	12	6	incubation, stream improvement, fishways	coho	2,000 Experimental water supply; dechlorinated tap water.	7	24
Terminal Creek	Bowen Island Rod & Gun Club	--	2	stocking, construction	coho	23,000 Transplant from Capilano hatchery.		345
Cheakamus River	Vancouver Sun/North Shore Outdoor School	3,000	2	incubation, construction	chum	29,000 Constructed mini-hatchery.	95	--
Hyde Creek	George Pearkes Secondary School	90	4	incubation, stream improvement	chum	12,000	75	96
Hyde/Yule Creek	Pacific Trollers Assoc.	7	6	incubation	coho	7,000	70	84
Laurentian Creek	Montgomery Junior Secondary School	40	4	studies, incubation in school, information	coho	3,000	60	36

Contact: Bryan Allen, SEP Community Advisor.

Location	Name of Group	No. of People Involved in 1982	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1982 Releases
Wilson/Hudson Cr.	Gibsons Wildlife Club	20	4	incubation, fishway, stocking	coho	3,300	55	37
					chum	2,300	66	36
Soames Creek	Granthams Wharf Rec. Association	6	2	incubation	chum	7,350	98	117
					cutthroat	—[1]		
Ouellette Creek	L & K Lumber Ltd.	20	5	incubation	chum	28,500	95+	456
Wakefield Creek	Sechelt Rod & Gun Club	10	4	incubation	coho	5,700	95	64
Lions Park Creek (Formerly Anderson Creek Project)	Pender Harbor Wildlife Society	20	4	incubation, rearing	chum	17,000	98	272
					coho	7,000	95	78
Deserted River	Native Environmental Studies School	25	3	incubation	chum	8,275	41	132
					coho	400	6	5
Roberts Creek	Roberts Creek Elementary School	30	1	rearing	coho	15	—[2]	1
Myrtle Creek	Powell River Rod & Gun Club	5	1	incubation, rearing	coho	Incubator not in operation in 1982.		

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[1] Not completed.

[2] Unavailable.

Contact: John Lewis, SEP Community Advisor.

Location	Name of Group	No. of People Involved in 1982	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1982 Releases
Scott Cove River	Broughton-Gilford Island Project	10	1	hatchery	coho	Fry trapping under way in April/83. Only construction in 1982.		

Contact: Bob Hurst, SEP Community Advisor.

Table 2

South Coast SEP Facilities*: Juvenile Releases 1982

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size(g)
Capilano Hatchery						
Coho	1980	grading study	277,122	26.1	N/A	17.50
Coho	1980	production, early release	36,282	57.7	N/A	18.16
Coho	1980	production	73,362	0	N/A	17.26
Coho	1980	size and time-of-release study	158,688	100	N/A	17.26
Coho	1981	upper watershed transplant	780,284	0	N/A	1.16
Coho	1981	watershed evaluation study	112,874	100	N/A	2.60
Chinook	1981	early release	338,925	11.8	76.5	3.95
Chinook	1981	mid-release	337,219	12.6		4.54
Chinook	1981	late release	316,852	13.5		5.30
Chinook	1981	transplant surplus	2,563	0		N/A
Seymour River Hatchery						
Coho	1980		64,000	45	N/A	20
Coho	1981		37,000	N/A	N/A	0.50
Steelhead	1980		7,840	N/A	N/A	41
Steelhead	1981		13,000	N/A	N/A	0.32
Cutthroat	1980		1,340	N/A	N/A	N/A
Cutthroat	1981		360	N/A	N/A	N/A
False Creek Sea Pens						
Chinook	1980	Capilano	5,800	N/A	N/A	N/A
Chinook	1980	Capilano	6,700	N/A	N/A	N/A
Cutthroat	1980	Abbotsford	1,072	N/A	N/A	N/A
Tenderfoot Creek Hatchery						
Chinook	1981	Cheakamus	95,982	81	88	5.50
Sechelt Community Development Project						
Chinook	1980	Capilano	9,800	100	46.25[1]	146
Coho	1981	Capilano	10,400	100	56.50[1]	40
Sliammon Hatchery						
Coho	1981	Sliammon	4,800	0	96.5	5.90
Chum	1981	Sliammon	990,000	0	82.5	1
Vancouver Bay Project						
Pink	1981	Skwawka	1,350,000	N/A	86	0.27
Chum	1981	Vancouver R.	65,000	N/A	92	0.46
Chum	1981	Saltery Bay	85,000	N/A	27	0.30

*Includes facilities constructed prior to SEP.

N/A means "not available."

[1] Low survival due to theft of fish from the pens.

Table 3

South Coast SEP Facilities: Status at December 1982*

Species	Stock	Brood	Stage	No. on Hand	Expected Release Date	Expected Release Number	Site
Capilano Hatchery							
Coho	Capilano	81	presmolt	607,737	June 1983	607,737	Capilano
Coho	Capilano	82	egg/ alevin	1,512,916	June 1984	1,500,000	Capilano
Chinook	Capilano	82	alevin	221,707	June 1983	220,000	Capilano
Chinook	Big Qualicum	82	alevin	620,945	June 1983	600,000	Capilano
Steelhead[1]	Capilano	81	yearling	1,481	Apr-May 83	1,400	Capilano
Steelhead[2]	Capilano	82	fingerling	12,061	Apr-May 84	12,000	Capilano
Steelhead[1]	Capilano	82	fry	12,346	Apr-May 84	12,000	Capilano
Seymour River Hatchery							
Coho	Seymour	82	egg	80,000	May 1984	80,000	Seymour
Steelhead	Seymour	81	fry	14,600	April 1983	14,600	Seymour
Steelhead	Seymour	82	fry	49,300	April 1984	49,300	Seymour
False Creek Sea Pens							
Coho	Seymour	81	smolt	2,700	April 1983	2,087	Alder Bay
Chinook	Capilano	81	smolt	16,500	May 1983	12,500	Alder Bay
Cutthroat	Abbotsford	82	smolt	2,000	--	1,219	Alder Bay
Tenderfoot Creek Hatchery							
Chinook	Ashlu R.	82	alevin	69,288	April 1983	63,000	Ashlu R.
Chinook	Cheakamus R.	82	alevin	36,432	April 1983	33,000	Tenderfoot
Chinook	Shovelnose C	82	alevin	73,554	April 1983	66,000	Shovelnose
Coho	Tenderfoot C	82	egg	160,000	May-Sept 83	144,000	Tenderfoot
Coho	Tenderfoot C	82	egg	35,000	May 1984	30,000	Tenderfoot
Coho	Squamish R.	82	egg	69,000	May 1984	62,000	Squamish R. tributaries
Sechelt Community Development Project							
Coho	local	80	presmolt	3,194	June 1983	3,100	sea pens
Coho	local	81	egg	4,340	June 1984	4,000	Porpoise B. pens
Chum	local	81	egg	71,050	May 1983	50,000	local crks.
Chinook	local	81	egg	1,575	June 1984	1,000	sea pens
Sliammon Hatchery							
Coho	Sliammon	82	egg	34,343	Feb. 1984	32,000	Sliammon L.
Chum	Sliammon	82	alevin	1,500,000	June 1983	1,400,000	Sliammon R.
Vancouver Bay Project							
Coho	Vancouver R.	82	egg	30,000	Sept 1983	30,000	Vancouver R.
Chum	Jitko Cr.	82	alevin	17,500	May 1983	17,500	Vancouver R.

*Includes facilities constructed prior to SEP.

[1] Winter-run steelhead.

[2] Summer-run steelhead.

Table 4

South Coast SEP Facilities*: Surplus Sales 1982

Species	Amount of Fish (kg)	Eggs (number)	Native Food Fish (pieces)	Value ($)
Capilano Hatchery				
Coho	62,237.06	0	0	83,378.46
Chinook	5,205.21	0	0	4,973.91
Mixed[1]	1,000.00	0	0	40.00
Coho	0	304,210	0	--[2]
Coho	0	77,709	0	1,050.00
Chinook	0	7,245	0	--[2]
Tenderfoot Creek Hatchery				
Coho	0	12,000	0	--[2]

*Includes facilities constructed prior to SEP.

[1] Coho and chinook sold together.

[2] No payment received; provided for research purposes.

Table 5

South Coast SEP Facilities*: Escapement to Facility 1982

Species	Escapement to Facility	Spawned for Hatchery Stock		% Marked
		male	female	male and female
Capilano Hatchery				
Coho	27,303	609	1,013	36.37
Coho (jacks)	1,963	0	0	37.39
Chinook	463	131	138	25.70
Chinook (jacks)	831	0	0	29.96
Steelhead (summer-run)	113	0	0	89.38
Sechelt Community Development Project				
Coho	1,200	3	6	88.89
Sliammon Hatchery				
Coho	120	46	34	12.00
Chum	9,336	279	570	N/A

*Includes facilities constructed prior to SEP.
N/A means "not available."

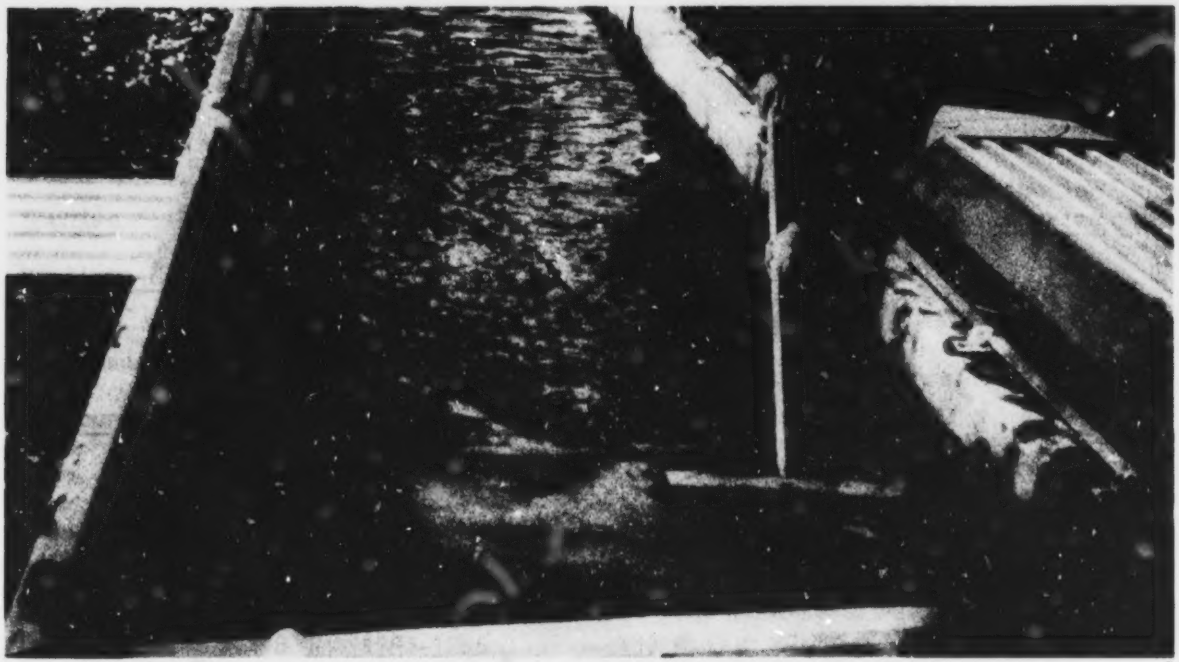
Table 6

South Coast SEP Facilities*: Adult Production

	Expected Production from 1982 Releases			At Full Production	
Species	Total Adult Production	Years of Return	Contribution to Fisheries	Total Adult Production	Contribution to Fisheries
Capilano Hatchery					
Coho	94,164	1983-1984	41,356	75,000	27,075
Chinook	31,141	1983-1986	21,705	60,000	43,895
Steelhead	168	1984-1985	104	800	400
Seymour River Hatchery					
Coho	7,944	1983-1985	4,646	4,700	2,725
Chum	--	--	--	720	313
Pink	--	--	--	1,000	481
Steelhead	678	1984-1985	406	1,300	756
Cutthroat	357	1984-1985	239	500	300
False Creek Sea Pens					
Chinook	5,318[1]	1983-1986	4,352	1,500	1,228
Tenderfoot Creek Hatchery					
Coho	--	--	--	7,500	4,582
Chinook	2,181	1983-1986	1,520	5,000	3,658
Steelhead	--	--	--	1,000	500
Sechelt Community Development Project					
Coho	3,788	1983-1984	2,310	9,100	3,289
Chinook	2,920	1983-1986	2,482	12,500	9,145
Chum	--	--	--	4,100	1,782
Sliammon Hatchery					
Coho	540	1983-1984	329	16,200	5,846
Chum	15,840	1984-1985	6,970	37,500	16,500
Vancouver Bay Project					
Pink	33,750	1983	16,234	15,000	11,100
Chum	1,200	1984-1985	528	16,000	7,040

*Includes facilities constructed prior to SEP.

[1] The 4,500 chinook caught in the False Creek children's fishery are included in this figure.



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Fraser River

1. *Spreading eggs on keeper channel screens at Chehalis River hatchery.*

2. *Four incubation boxes for coho were installed on a small tributary of the Coquitlam River by a job creation crew.*

3. *Eggs are taken from a mature steelhead at Chilliwack River hatchery.*

Fraser River

Pitt River Reconnaissance

A cursory reconnaissance survey of the upper Pitt River was undertaken to determine the feasibility of constructing an enhancement facility on this system. It would appear that a new potential site exists on Blue Creek in addition to the opportunity for a joint development at the existing IPSFC site.

Contact: George Nielsen, Senior
Project Engineer,
Engineering.

Inch Creek Hatchery

Inch Creek hatchery located 12 km east of Mission was expanded in 1982 to allow for increased chum incubation and rearing as well as extended rearing of coho. The capacity of the hatchery has been increased from four million to eight million chum eggs. Extended rearing for 500,000 coho has also been added.

Expansion of the facility was started in July and completed by November. The new work includes:

- expansion of the main hatchery building by 180 square metres to provide larger incubation, office and workshop areas as well as washroom facilities
- extension of the water supply and drainage system to service the expanded facilities
- addition of six, 3 m by 21 m, reinforced concrete channels for extended onsite coho rearing
- general site grading and landscaping.

Plans and tenders for upgrading the Inch Creek groundwater supply in 1983 are well underway. New pumps will boost the existing water supply of 6,600 litres per minute (LPM) to an ultimate supply of 20,000 LPM from the two operating wells. Feasibility studies and designs for expansion of the aeration tower have also been completed.

Egg targets for 1982 were two million Blaney Creek chum eggs, two million Inch Creek chum eggs, four million Stave River chum eggs and 250,000 coho eggs. Coho brood stock were obtained from Inch, Pye, Barnes, Deroche, Siddle and Norrish Creeks.

Stave River chum were captured by beach seining and the majority of the egg-takes were carried out at the Stave River. A total of 3.5 million eggs were collected.

Brood stock capture on Inch Creek was accomplished with a fence trap. Adult escapement to the creek was the most successful to date. Total escapement was 8,500 chum; almost 9 percent were marked fish from the 1978 brood year.

Blaney Creek had a low adult escapement of 710 adults; this corresponds to years of low fry releases. The hatchery was unable to meet the 1982 egg target of two million chum eggs, but obtained 600,000 eggs.

Coho adult capture was quite successful in 1982, and the target of 250,000 eggs was exceeded. Although there is space available to rear 500,000 coho, the hatchery requires more water, a situation that will be addressed in 1983.

Contact: Bill Foye, Stock Enhancement
Officer; Dave Harding,

Technical Support Biologist, Enhancement Operations; Alain Ho, Project Engineer, Engineering.

Alouette River Hatchery

Alouette River hatchery is located on the South Alouette River at the Correctional Center 10 km northeast of Haney. This project was initiated to provide meaningful work for inmates of the Alouette River Corrections Camp and to help rehabilitate the salmonid stocks of the Alouette River system.

The Alouette River project is operated by the inmates and supervisory staff of the Alouette River Correctional Center. Some 117,000 chum eggs and 51,000 coho eggs were taken in the fall of 1982. These eggs are presently incubating and will be reared on water from a new well drilled in spring 1982. (Low survival rate of 1981 brood chum was due to an iron precipitate in the water supply, which suffocated the fry.) Standard water quality and bacterial analysis tests are being conducted on the well water with the expectation that full production for the facility will begin with the 1983 brood.

In addition, the facility is rearing 20,000 coho smolts, part of an ongoing coho recolonization program planned for the Brunette River which drains into the Fraser River at New Westminster. Six thousand steelhead smolts are also reared at the hatchery. These will be released into the Alouette system. All fish held on site will be tagged prior to release.

Contact: Kim West, Biologist, Special Projects.

Fraser Valley Trout Hatchery

Fraser Valley trout hatchery is operated by the provincial Fish and Wildlife Branch and is involved in many SEP projects. Species of trout produced include rainbow, coastal cutthroat and steelhead. In 1982, eight stocks of steelhead and nine stocks of anadromous cutthroat were incubated and reared to various sizes before release or transfer to satellite rearing sites on the Lower Mainland and Vancouver Island. Elevated water temperatures are used in incubation and rearing to ensure that fish reach a suitable size at the appropriate time of release.

Public displays at Fraser Valley trout hatchery, along with education programs are used by tour guides to interpret the Salmonid Enhancement Program for the general public and school children.

Adult sea-run cutthroat and steelhead brood stocks required for fry and smolt stocking projects are collected in various ways. Electroshocking equipment was used to capture cutthroat adults from several small tributaries of the Fraser River as well as the Nicomekl and the Serpentine Rivers. Angling is the predominant method for capturing steelhead from larger rivers, such as the Coquihalla, Silverhope and Squamish. The Semiahmoo Fish and Game Club supplied adult steelhead from their enumeration fence on the Little Campbell River. The Coast Steelheaders Club angled brood stock in the Squamish River.

About 46 percent of 72 adult summer steelhead taken from the Coquihalla River were of hatchery origin. Hatchery Coquihalla progeny, together with wild Silverhope fry, were used for fry stocking the upper Silverhope for the fifth year in a row. Progeny of wild and smolt stockings into the Coquihalla River.

Steelhead fry (1-5 g) were also released into the Ashlu River (Squamish), Shovelnose Creek (Squamish), Little Campbell River (White Rock), Marshall Creek (Abbotsford), South and North Alouette Rivers (Maple Ridge) and the

Suskwa River (Smithers). Fry stockings into vacant or underutilized habitat have shown encouraging results to date.

Anadromous cutthroat fry (1-5 g) were also released into several streams, including Colquitz Creek (Victoria), Little Oyster River (Black Creek), Bear and Murray Creeks (Langley), Scott and Hoy Creeks (Port Moody), deBouville Creek (Port Coquitlam) and Silverdale Creek (Mission).

Smolts released from offsite rearing locations in 1982 once again made a substantial contribution to overall production. Inch Creek hatchery produced 24,000 cutthroat smolts which were released into the Brunette River (Burnaby), the Stave River (Ruskin) and the Nicomen Slough (Mission). Surrey rearing ponds produced 4,000 steelhead smolts for the Little Campbell River (White Rock) and 21,600 cutthroat smolts for the Serpentine (Surrey), Nicomekl (Langley) and Little Campbell Rivers.

Steelhead smolts are also produced at the main hatchery. Into the Coquihalla, 38,500 tagged steelhead smolts were released at various times. The tags will help to pinpoint the best time of release for smolts into the river. Into the South Alouette River, 20,000 smolts were released, 15,000 smolts into the Nicomekl River, and 2,700 smolts into Marshall Creek. For the second year, 6,000 steelhead of Alouette River origin were transferred from the main hatchery to the Alouette River Correctional Center at Maple Ridge. These fish will be reared to smolt size by inmates and supervisory staff and then released into the South Alouette River.

Modifications were made to the adult holding facilities for steelhead and cutthroat brood stocks. The isolation-type holding boxes were expanded to better accommodate the large numbers of winter steelhead. Additionally, group holding boxes were replumbed to include individual water systems. Routine preventative disease treatments were modified. The end result of these changes was a dramatic reduction in prespawning adult losses due to fungus and stress.

Air spawning replaced the incision method as the principal means of spawning steelhead at the hatchery. Egg losses using this technique are comparable to incision and extrusion methods. Adult survival is excellent. Most adults were tagged and released into their natal streams after spawning.

Contact: Don Peterson, Hatchery
Supervisor, Fraser Valley
Trout Hatchery, Abbotsford.

Peach Creek Side Channel—Vedder River

Peach Creek side channel lies between the Vedder River mainstem and set-back dyking on the north bank, just west of Vedder Crossing.

In 1981, selected side channel areas within the Vedder River management area were assessed for salmonid enhancement opportunities. This investigation concluded that Peach Creek side channel offered the best opportunities for enhancement of overwintering habitat for juvenile trout and coho salmon, and advised further investigations in 1982 to confirm and quantify this enhancement potential.

In 1982, electroshocking was conducted in order to confirm the 1981 findings. So as to best assess the absolute value of cover components such as boulders under winter conditions, only the cover elements themselves were sampled for fish. Lengths were taken of all fish captured to help determine fish age. Following fish sampling, the entire length of Peach Creek side channel was described in terms of site-specific improvements that could be made.

Data suggest that full habitat development in Peach Creek side channel could provide refuge for an additional 12,000 to 36,000 juvenile rainbow trout and a similar number of coho fry during the winter months. It is thought that juveniles immigrate into Peach Creek side channel from the Vedder River mainstem during the winter. In view of the lack of other suitable cover, fish not successfully accommodated in Peach Creek side channel would otherwise perish. Due to the straightness and uniformity of the channel, alternating rock wing deflectors seemed most suitable to improve winter rearing habitat. In riffles and in shallow glides, mid-channel areas and sections of stream between the deflectors should be provided with boulder additions suited primarily to trout. In glide areas the emphasis should be placed on organic cover, such as anchored logs, to benefit both juvenile coho and trout.

Contact: Bob Griffith, Fisheries Biologist, Fish Habitat Improvement Section, Fish and Wildlife Branch, Victoria.

Chilliwack River Hatchery

Chilliwack River hatchery is located at the confluence of Slesse Creek and the Chilliwack River, 19 km east of the Vedder Crossing bridge and 32 km southeast of the city of Chilliwack. Phase I of the hatchery was completed in April 1981.

Phase I capacity is designed for five million chum fry, 500,000 coho smolts, 500,000 chinook smolts, and 150,000 steelhead smolts. Phase II construction, planned for 1983/84, will accommodate an additional five million chum and 500,000 coho.

In 1982, 1.5 million Harrison River eyed chinook eggs were transferred from the Chehalis River hatchery to Chilliwack. From these, 1.2 million fry were ponded. As initial rearing capacity was insufficient for all the salmon fry, 325,000 Harrison chinook were ponded in three legs of a chum keeper channel. Initial rearing in this keeper channel has been very successful to date, with minimal losses recorded and growth rates exceeding those of Harrison chinook in the Capilano troughs.

The 1982 egg-take target of 500,000 coho was exceeded by 200,000 eggs, owing to a large number of wild coho that voluntarily entered the holding area. The egg-take target of 4.2 million chum eggs in 1982 was also met.

In May 1982, 66,389 steelhead smolts, averaging 107 grams, were released offsite by provincial Fish and Wildlife staff. These smolts represented the results of a cooperative incubation/rearing program between Chilliwack River hatchery and the Research Section of the Fraser Valley trout hatchery. The ability of the Fraser Valley hatchery to accelerate incubation and early rearing with higher water temperatures made it possible to attain the desired, larger-size smolts at the time of release.

As part of an imprinting study, coho smolt releases were divided between hatchery releases and stream-of-origin releases. Some of these fish were held and fed for varying periods of time before release to determine the effect on the imprinting process.

Steelhead brood stock was captured by anglers and successfully held at Chilliwack River hatchery this year in both isolation boxes and concrete raceways. Fifteen females were spawned using the air-spawning technique. Air introduced into the trout's body cavity, forces her eggs out naturally through the genital pore. The additional advantage is that the steelhead can then be released unharmed. Steelhead eggs were incubated at Chilliwack River hatchery for the first time in 1982, and survival rates were very good.

As in 1981, a major effort was made in 1982 to capture brood stock from the very small indigenous population (about 50) of red-fleshed chinook in the Chilliwack River system. Three females were spawned. An exceptional egg-to-fry survival of 98 percent resulted in the ponding of 12,000 chinook fry.

In 1982, 100,644 chinook from the upper Pitt River were reared at Chilliwack River hatchery, and 50 percent of these fish were airlifted back to their stream of origin (Blue Creek) for release. The remainder were released from Chilliwack hatchery.

High ammonia and pH levels in one of the groundwater wells at Chilliwack has limited its use for incubation. Remedial action is being taken. Problems with gill damage in swim-up chum fry also developed in 1982. No single environmental condition could be identified as the cause, but silt and above normal ammonia levels are suspected. Lower than normal loading densities in keeper channels may be necessary to correct this situation.

Contact: Don Buxton, Stock Enhancement Officer; Dave Harding, Technical Support Biologist, Enhancement Operations.

Chehalis Band Project

This project, located in the Upper Fraser Valley on the Harrison River, facilitates the training of local residents in fish culture techniques and project management to prepare them for potential employment at Chehalis River hatchery. One aspect of this training is egg collection from several creeks and rivers for Chehalis and Chilliwack hatcheries. In 1982, the crew collected 500,000 Harrison River chinook eggs for the Chilliwack hatchery; and 1.6 million chinook eggs, 316,000 coho eggs and 3.5 million chum eggs for the Chehalis hatchery.

The project investigated alternative rearing strategies for chinook salmon, assessed incubation pits, and improved groundwater-fed sloughs for chum production.

The project has endeavoured to salvage and maintain the genetic integrity of a declining stock of Chehalis River chinook.

In 1982, the Chehalis Band operated its pilot hatchery designed for 100,000 chinook eggs which is located on Smokehouse Slough on the Chehalis Band Reserve.

The Band enumerated chum fry produced in two incubation pits located on John Mack and Jimmie Charlie Sloughs and in the improved Ed Leon Slough, now a spawning channel. A stream improvement program for the Chehalis Flats area consisted of monitoring and breaching beaver dams on a need-specific basis.

In the fall of 1982, chum spawners in improved sloughs and spawning channel were counted by means of fence counts and mark and recovery methods.

The Chehalis Band Council, as contractor, can employ nine people full-time although crew size ranges from three to 14 people, depending on workload throughout the year.

Contact: Chris de Hrussoczy-Wirth, Project Coordinator, Special Projects Division.

Chehalis River Hatchery

Chehalis River hatchery is located approximately 95 km east of Vancouver near Harrison Mills. The hatchery is adjacent to the lower Chehalis River three kilometres upstream from its confluence with the Harrison River. The facility has a capacity for 14 million chum eggs, 3 million chinook eggs, 750,000 coho eggs, 240,000 steelhead eggs, and 42,000 cutthroat eggs. A mixture of conventional and Japanese-style hatchery methods are used at this facility.

In 1982, groundwater wells were drilled and an aeration tower constructed at Chehalis hatchery. Piping to deliver both surface and groundwater was installed. Concrete and earthen rearing ponds and aluminum troughs were built or installed, and the general hatchery site was serviced for lighting and adequate drainage.

Chehalis River hatchery became operational in October 1982. Most of the brood stock for the hatchery was collected by the Chehalis Indian Band under contract. Fish were seined, gillnetted, or trapped in the Harrison and Chehalis Rivers as well as in a number of smaller tributaries. After capture, most of the fish were transported to the hatchery for holding and egg-takes. A job creation crew collected chum and coho brood stock from a number of streams for the hatchery. Eggs obtained from these stocks were in addition to the egg collection originally planned for the Chehalis hatchery in 1982.

In total, nine million chum eggs, 2.8 million chinook eggs and 500,000 coho eggs were collected, bringing the hatchery to within 60 percent of full production in its first year of operation. Approximately 1,450,000 of the chinook eggs collected at Chehalis hatchery were transferred at the eyed stage to Chilliwack River hatchery in an attempt to rebuild a strong chinook run to the Chilliwack River. Approximately 22,000 chinook eggs were also donated to the Correctional Service for a project on the Stave River.

The Chehalis River hatchery is designed to produce increased catches for the commercial, sport and native food fisheries, of approximately 150,000 chum, 58,000 chinook, 48,000 coho, 4,000 steelhead, and 3,000 cutthroat trout. The hatchery should attain full production in 1983/84.

Contact: Larry Kahl, Stock Enhancement Officer; Dave Harding, Technical Support Biologist, Enhancement Operations; Wai Leung, Project Engineer, Engineering.

Sea-run Cutthroat, Hope/ Camp Sloughs

Stocking of sea-run cutthroat trout smolts continued on the Hope/Camp Sloughs in 1982. A total of 11,347 smolts, averaging 63.2 g in weight, were released.

An enumeration fence was put into operation late in 1982. A total of 57 marked cutthroat were checked through the trap between September and December. These fish were mainly from the 1981 release (80.7 percent), with the remainder from the brood years 1979 and 1982, at 7.02 percent and 12.3 percent respectively. Due to poor conditions and peak flows in the Hope/Camp system, the trap did not operate full-time and much of the run may have been missed, as cutthroat tend to move through this system on peak flows. Ninety-eight angler-caught fish were reported during the same period from these systems. Angler cooperation greatly improved in 1982, but clip identification is still deficient. Most trout are reported as having only their adipose fin clipped, and other fin clips are often missed. A large number of hatchery cutthroat were reported taken at the mouth of the Vedder Canal in August and September. An intense creel survey is planned for this cutthroat fishery in August 1983.

Contact: Bob Land, Research Section,
Fraser Valley Trout Hatchery,
Fish and Wildlife Branch,
Abbotsford.

Jones Creek Spawning Channel

Jones Creek spawning channel is located approximately 16 km southwest of Hope. The channel was constructed in 1954 as a solution to salmon problems created by diversion-type hydroelectric development at Jones (Wahleach) Lake.

The Wahleach hydroelectric project of the B.C. Electric Company (now B.C. Hydro and Power Authority) resulted in the diversion of a large proportion of the natural water flow from Jones Lake into penstocks at the Wahleach power generating station located 13 km downstream from the mouth of Jones Creek, and adjacent to the Fraser River. In order to compensate for the impact of reduced and irregular flows, the B.C. Electric Company constructed the channel adjacent to lower Jones Creek according to Department of Fisheries' specifications. The company agreed to maintain the channel and to provide sufficient flows to ensure its successful operation. The operation of the channel has been carried out by the Department of Fisheries and Oceans. An average of 2,000 pink salmon utilize the channel in the odd years. A few chum salmon and the odd coho also use the channel. The optimum number of spawners for the channel appears to be about 2,050 adults.

In 1982, pink and chum fry were trapped in a downstream trap as they migrated out of the channel. The total migration was enumerated and spanned the period from late March to early June. Approximately 1,572,000 pink fry and 251,000 chum fry were produced. Egg-to-fry survival was 71 percent for pink salmon, the highest on record for the channel. Egg-to-fry survival for chum was also very high, approximately 90 percent. The estimated contribution to commercial fisheries will be 28,700 pink salmon and 900 chum salmon.

Contact: Larry Kahl, Stock Enhancement Officer; Dave Harding, Technical Support Biologist, Enhancement Operations.

Birkenhead River Hatchery

Birkenhead hatchery is located 2 km north of Mount Currie on the Birkenhead River and is in its sixth year of operation.

In the spring of 1982, 36,500 1981 brood year chinook fry were released into the Birkenhead River. There were no additional fry held over for additional rearing as in the past two years.

The 1982 adult capture program was the most successful in the history of the facility. All chinook capture was accomplished entirely by angling. Adults were transported back to the hatchery site, held for up to three months until ripe, and then spawned.

The 84 adults captured included two hatchery fish from the 1977 brood year. Preliminary evidence from scale and otolith readings shows that this stock is composed of primarily 5-year-olds (up to 45 percent).

More than 164,000 eggs, a record for this facility, were collected in 1982, slightly surpassing the design capacity of 150,000 eggs.

A coded-wire tagging program will be undertaken in spring 1983 to evaluate time of release and size at release.

Contact: Bill Foye, Stock Enhancement Officer, Enhancement Operations.

Nicola River Reconnaissance/ Feasibility

EVS Consultants Ltd. carried out studies of coho spawners in the Coldwater River, which is a major tributary of the Nicola River.

Reconnaissance and feasibility studies were focussed on two main sites in the Nicola Valley; one on the Nicola

River immediately downstream of Nicola Lake, and the other on Spius Creek near its confluence with the Nicola. Possible sites within the town of Merritt were reviewed and rejected on the basis of economic and logistic considerations. Reports of a possible artesian water supply on the Coldwater will be investigated during 1983. Due mainly to the relative ease of land acquisition, the Spius Creek site has been selected for the construction of a pilot facility (details are provided in the Central Interior Special Funding Initiative Section).

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations; George Nielsen, Senior Project Engineer, Engineering.

South Thompson Reconnaissance/Feasibility

Pilot facilities at Spius Creek and on the middle Shuswap River are being developed through a separate funding initiative (see section on the Central Interior Special Employment Initiative). Potential chinook, coho, and steelhead trout rearing capacities of selected streams, proposed as outplant locations in the South Thompson watershed, are being evaluated in a federally-funded study done by the Fish Habitat Improvement Section of the B.C. Fish and Wildlife Branch. Studies of coho spawners in the Eagle, Salmon and Adams Rivers were undertaken by EVS Consultants Ltd. in 1982. Water quality sampling and temperature monitoring of the Wilkie Dam reservoir were continued through 1982.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations; George Nielsen, Senior Project Engineer, Engineering.

Thompson River Reconnaissance

The feasibility of utilizing cooling water discharged from the Westcoast Transmission pumping station at Savona as a hatchery water supply was investigated through 1982. There is a considerable amount of prior data available on temperature and water quality. Uncertainties about this site presently center on problems associated with pollution levels downstream of major municipal and industrial effluent discharges. Land acquisition for a hatchery site may also prove difficult.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations; George Nielsen, Senior Project Engineer, Engineering.

Eagle River Hatchery

In 1982, biological reconnaissance studies were conducted of the Eagle River and several streams designated as possible outplant locations. The studies included determination of coho spawning habitat and juvenile rearing capacity. Also, reports on the juvenile and adult studies undertaken in 1981 on the Eagle, Adams, Salmon, and mainstem South Thompson Rivers were completed by EVS Consultants Ltd.

Final design and construction of a pilot facility for 1,000,000 chinook and coho eggs started in June 1982 and was successfully completed in the fall. A total of $400,000 was spent on site-work, a release channel, a wood frame, metal-clad hatchery building, standby generator, a pumphouse, and an aeration tower. The building provides cover for eight intermediate rearing troughs. Four aluminum raceways were also installed for final rearing.

The water supply system has run continuously through the winter under the supervision of an on-site maintenance person hired through the job creation program.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations; Wayne Peterson, Senior Project Engineer, Engineering; Ron Mowbray, Project Technician, Engineering.

Central Interior Tribal Councils Fisheries Program

The Central Interior Tribal Councils represent native communities throughout most of the southern third of the province. The western boundaries are marked by Pemberton and part of the Chilko River. The northern boundary is in the vicinity of Williams Lake, and the B.C./Alberta border forms the eastern boundary. The U.S./Canada international border forms the southern boundary, west to the height of land east of the Fraser River up to Boston Bar. Most of the present fisheries activities are concentrated along the Fraser River from Boston Bar to north of Lillooet, the Lillooet and Bridge River systems, and the entire Thompson River drainage.

The purpose of this program is to identify salmonid enhancement opportunities and to develop specific proposals in conjunction with adjacent native communities. The program monitors river fisheries to assess their impact on fish stocks. The program also identifies community needs and historical aspects of the traditional river fisheries in order to develop a comprehensive fisheries management proposal.

In 1982, the Fisheries Program prepared a preliminary overview of enhancement opportunities identified from all documented past and ongoing studies in the region.

The Central Interior Tribal Councils are the contracting agency. Their contract provided 1.3 person-years from its August 1, 1982 commencement date. Project staff consist of a biologist and a technician.

Expansion of the Community Economic Development Program (CEDP) into the Fraser River system will be based on sound planning. Indian governments and the Department of Fisheries and Oceans will develop a factual data base from which to work out management strategies.

Contact: Chris de Hrussoczy-Wirth, Project Coordinator, Special Projects Division; Roger Stewart, Biologist, Central Interior Tribal Councils, Kamloops.

Central Interior Special Employment Initiative

Five pilot projects in the central interior of British Columbia were funded as part of a Government of Canada Special Employment Initiative in the Fraser-Thompson area. These pilots will allow early assessment of the potential for chinook and coho production facilities in this area.

Clearwater River

The Clearwater River drains into the North Thompson River immediately downstream of Clearwater.

The proposed site is located within the village limits of Clearwater. Negotiations are being completed to purchase a private property on which the site is located. Topographical and hydrological surveys and a well-drilling and exploration program were successfully completed in 1982.

Spius Creek

Spius Creek drains into the Nicola River approximately 18 km downstream of Merritt. The proposed site is located on Spius Creek near its confluence with the Nicola River. Application has been made to reserve Crown land for the hatchery. In 1983, plans call for topographical and hydrological surveys of the site, a groundwater exploration and drilling program, and construction of the proposed pilot hatchery.

Shuswap River

The middle Shuswap River connects Sugar Lake and Mabel Lake. The proposed site is located immediately downstream of Shuswap Falls, 12 km northeast of Lumby.

Topographical and hydrological surveys of the area have already been completed. In 1983, plans call for a groundwater exploration and drilling program and construction of the pilot hatchery.

Adams River

The Adams River drains Adams Lake into Shuswap Lake 12 km northeast of Chase. It is the spawning grounds for the famed Adams River sockeye run.

In 1982, a record return of two million sockeye spawners drew over 200,000 visitors to the "Salute to the Sockeye" exhibit on the Adams River.

In order to familiarize the public with proposed enhancement plans for coho and chinook salmon in the interior of British Columbia, a "demonstration pilot" display was constructed at the "Salute to the Sockeye" site. This popular exhibit consisted of display panels that explained chinook and coho biology and fish culture technology. As well, the exhibit had working examples of a groundwater supply, aeration tower, and incubation and rearing containers.

Stuart River

Modifications were made to the Stuart pilot facility located three kilometres north of the Stuart River within the village limits of Fort St. James.

The Stuart River pilot was initially constructed and operated in 1980/81 to test the feasibility of fish culture using an artesian water supply containing high levels of iron. Due to late construction, only salmon fry were tested in the water supply in 1980/81. The pilot was not operated in 1981/82 because of a funding shortage. Special funding in 1982/83, however, provided the opportunity to upgrade the pilot and to carry out tests for the incubation of eggs. Results to date suggest that this site can be used for production with only minimal treatment of the water supply required.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations; George Nielsen, Senior Project Engineer, Engineering.

Louis Creek Coho Hatchery

In 1982, a small hatchery was constructed at the headwaters of Christian Creek by SEP's Small Projects Unit. Labor was provided by the Raleigh Corrections Camp, the Vancouver Sun's Save the Salmon program and local volunteers.

This facility has the potential capacity to rear 250,000 coho to a release weight of five grams. This is assuming that the project can tap into an adjacent groundwater-fed stream, and continue to use the existing artesian well.

In 1982, 38,000 Louis Creek coho eggs were incubated in gravel and bio-ring incubation cells. The gravel and bio-ring fry weighed 0.35 and 0.25 g respectively after emergence. Egg-to-fry survival was greater than 90 percent in both instances.

The fry attained a mean weight of five grams after four months of rearing in Capilano troughs. Some 18,000 fry were tagged in June, and then released at numerous sites along Louis Creek. The remaining 13,000 fry were lost one week before the scheduled release owing to a pump failure at the hatchery.

Table 7

Experimental Strategy and Size of Central Interior Pilots

Project	Purpose	Sp[1]	Stocks	No. of Eggs	Expected Adult Production
Clearwater	- investigate upstream plus downstream homing responses/release strategies	CN	Clearwater	110,000	1,800
		5g	Raft	110,000	1,800
			Fin	110,000	1,800
			Lemieux	110,000	1,800
	- adult experience/data collection	CO	Lion	105,000	2,300
	- 5 g outplant evaluation	5g	Dunn (or alternate)	105,000	2,300
Spius	- outplanting to underutilized areas	CN 5g	Coldwater	110,000	1,800
			Spius	110,000	1,800
	- adult experience data collection	CO	Coldwater	105,000	2,300
	- 5g outplant evaluation	5g			
	- testing of use of solar energy to heat hatchery water				
	- overland effluent disposal				
Shuswap	- 2g outplanting to upstream unutilized area	CN	Shuswap	110,000	1,800
Adams	- public display				
Stuart	- effect of marginally high iron in artesian water supply	CN 5g	Stuart	110,000[2] 77,000[3]	1,800

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[1] species: CN=chinook; CO=coho; reared to five-gram weight.
[2] design capacity.
[3] taken in 1982.

The Louis Creek hatchery will continue to operate as a pilot facility until 1984.

Contact: Mel Sheng, Biologist, Special Projects Division.

North Thompson Reconnaissance/Feasibility

Reports on the baseline juvenile and adult studies undertaken in 1981 on the Blue, Finn, Lion, Raft, and mainstem North Thompson Rivers were completed by EVS Consultants Ltd. In 1982, Envirocon undertook complementary juvenile studies of the Clearwater, mainstem

North Thompson, Finn, Raft, Joseph, Dunn, Lemieux, and Barriere River systems. Coho spawner sampling and surveys were done in conjunction with a Field Services NEED (job creation) project in the area.

As part of the Central Interior Special Funding Initiative (detailed elsewhere), a pilot facility is being developed in the town of Clearwater. Monitoring of this and other potential facility sites continued through 1982.

a) Finn Creek
Finn Creek flows in a southwesterly direction and discharges into the North Thompson River 16 km north of Avola.

A second groundwater well was drilled at Finn Creek, which resulted in an artesian steady-state flow of approximately 750 litres per minute (LPM) of marginally soft water at 6-6.5°C.

A prefabricated steel building was constructed around the well. A packed-column aerator and head tank were constructed within the building, and the artesian flow is now being passed through this system to allow seasonal monitoring of flow, water quality, and temperature. The discharge of Finn Creek is also being monitored. Dependent on the results, this site could be utilized in 1983 as a small incubation/rearing facility, perhaps implemented as a public involvement project.

b) Lion Creek
Lion Creek flows east into the North Thompson River 11 km north of Avola. Monitoring of its discharge is being continued in 1982.

c) Mahood River
Mahood River flows southeasterly into Clearwater River, 35 km north of Clearwater. The well, developed in 1981, continued to be sampled with regard to water quality and monitored for temperature through 1982. Initial results indicated good-quality water for fish culture, except for high mercury levels in both the well and river. This aspect will require further investigation.

d) Clearwater River
In addition to new wells drilled for the pilot facility, two existing wells belonging to local residents in the town of Clearwater are also being sampled and their temperatures monitored. Although water quality is generally suitable for fish culture in all wells, the thermal behavior of the aquifer(s) appears to be variable and unusual. Dutch Lake, which has no outflow may be contributing significantly to the aquifer. Investigations are continuing on this aspect.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations; George Nielsen, Senior Project Engineer, Engineering.

Loon Creek Hatchery

The provincial Fish and Wildlife Branch operates a small hatchery at Loon Creek, located 23 km north of Cache Creek, for stocking trout in lakes in the northern interior of the province. This hatchery was recently renovated with the express purpose of rearing 150,000 chinook salmon and 40,000 steelhead smolts for the enhancement of Bonaparte River stocks.

High water conditions in the Bonaparte River prevented the collection of steelhead brood stock in 1982. Adult brood stock (12 females and seven males) from the Deadman River were substituted to reach the 40,000 smolt target. Three adults were lost during holding. About 57,000 eggs were collected and transferred to Fraser Valley trout hatchery for incubation. The resulting fish were returned to Loon Creek hatchery in October and reared on spring water. They will be marked and released into the Bonaparte River in 1983.

Adult steelhead (14 females and three males) were also captured from the Nicola River in 1982 and held in isolation boxes at Loon Creek hatchery. Approximately 82,250 eggs were collected in May, and the resulting 38,000 fry were released as unfed fry into Maka and Spius Creeks, both tributaries of the Nicola River.

Chinook brood stock (17 females and nine males) were captured by angling and held in an earthen pond and isolation boxes at Loon Creek hatchery. About 40,300 eggs were taken, well short of the 150,000 target. All fry will be marked prior to release in the Bonaparte River.

Loon Creek hatchery will continue to be a major component in the provincial freshwater fisheries program, stocking some 2.5 million rainbow trout annually.

Contact: Dennis Graf, Hatchery Supervisor, Fish and Wildlife Branch, Cache Creek.

Chilcotin River Reconnaissance

Three sites were identified in 1981 as having enhancement potential:

- a groundwater spring on the right bank of the Taseko River approximately 8 km upstream of the Taseko-Chilko confluence
- groundwater seepages at the confluence of the Chilko and Little Chilcotin Rivers
- an artesian well at the Puntzi Mountain airbase on the Chilanko River.

Water quality and temperature were monitored at these sites through 1982.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations; George Nielsen, Senior Project Engineer, Engineering.

Quesnel River Hatchery

This major chinook hatchery is located 85 km east of Williams Lake and two kilometres south of Likely. The design capacity of this facility is 3.9 million eggs. This facility, when in full production, will incubate eggs from the Blackwater, Bowron, Cottonwood, Quesnel, Slim, and Willow River systems. Construction of this hatchery began in the fall of 1980 and was completed in the summer of 1982. Initial pilot operation began in 1981. The final incubation and rearing of chinook stocks on a pilot scale was contracted out to Envirocon Ltd., from December 1981 through May 1982. The completed facility went into 42 percent production in 1982 and was operated by Fisheries and Oceans staff. Full production capacity is expected to be attained in 1983.

Pilot Hatchery Operation

Under a contract with Envirocon Ltd., 80,128 chinook fry were ponded in January 1982 and 62,300 fry were released in mid-May. Some 57,353 of these chinook fry were tagged.

Major Facility Operation

Under Fisheries and Oceans supervision, this facility went into major operation in late August 1982. The Blackwater, Bowron, Quesnel, and Slim Creek systems were used to supply chinook brood stock. Bowron River and Slim Creek chinook eggs were transported from the Penny facility to the Quesnel River hatchery for incubation.

All brood stocks from the Blackwater, Bowron, and Slim Creek systems were stripped of their eggs and milt at the donor stream and these gametes were then flown by helicopter to the hatchery site for fertilization, incubation, and rearing.

A major genetic experiment was initiated with the Quesnel River chinook stock. Fifty percent of this stock consists of fish with white flesh, whereas the remainder have red flesh. Adults of this stock were mated in the following crosses; red male with red female, red female with white male, white female and white male, white female and red male.

These four crosses were incubated and reared separately, and will be tagged distinctively. This experiment will provide comparative information on the fertilization rates, growth rates, adult returns, and adult flesh coloration of each of these genetic crosses.

Contact: Robin Dickson, Stock Enhancement Officer; Gordon Bérézay, Technical Support Biologist, Enhancement Operations.

Bowron River Reconnaissance/ Feasibility

An in-house report was completed on the 1980/81 pilot installed on a groundwater spring tributary to the Bowron River approximtely 65 km downstream of Bowron Lake. The pilot study concluded that chinook could be successfully reared in 3.5-4.0°C, if a mid-August release of fry is acceptable. Due to the uncertainty involved with the production potential of this strategy, as well as problems associated with gas supersaturation, low flows, and servicing such a remote site, it was decided to satellite Bowron chinook stock into the Quesnel River hatchery. A total of 24,000 fry were successfully tagged and released in 1981. Adult returns must be monitored, beginning in 1984, in order to determine the success of a late-summer release. A reconnaissance report on a second groundwater-fed channel, flowing into the Bowron River 1.5 km downstream of Bowron Lake, was also completed in 1982. This site is regarded as having better potential for a future hatchery than does the lower site, as it is more accessible, water temperatures are warmer, and it is closer to the natural spawning grounds in the Bowron River. In the more immediate future, it may be developed as a juvenile imprinting/adult brood stock holding satellite in support of the Quesnel facility. Prior to development, however, the feasibility of aeration of the existing channel must be investigated.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations; George Nielsen, Senior Project Engineer, Engineering.

Upper Fraser Reconnaissance

Beak Consultants Ltd. completed reports on their 1981 adult and juvenile baseline studies of the Holmes, Morkill, Torpy, and Slim River systems, which are all tributaries of the upper Fraser River.

An in-house report on biophysical data collected during 1982 chinook egg-takes on the MacGregor River system (for the Penny facility) is available.

In general, the potential for major enhancement sites along the Fraser River upstream of Prince George appears to be quite low.

Contact: Bruce Shepherd, New Projects Coordinator; Robin Dickson, Stock Enhancement Officer, Enhancement Operations.

Penny Pilot Hatchery

This pilot chinook hatchery is located 105 km east of Prince George on the north side of the Fraser River. This satellite facility, which has a capacity to incubate and rear 200,000 chinook fry to release, started operation in the summer of 1980 and was upgraded to its present size in 1981.

In the winter through early summer of 1982, incubation and rearing of Bowron River and Slim Creek chinook stocks occurred at the Penny facility. Some 84,435 Bowron River stock and 67,058

Slim Creek stock were released back into their donor streams. These releases represent 83.5 percent and 74.7 percent egg-to-fry survival rates respectively. All fry were transported by helicopter from the Penny hatchery site to the donor stream release sites.

An imprinting experiment was carried out on both stocks at the time of release. These experiments were designed to determine whether or not it is necessary to hold fry in order to imprint them to their native stream. The experimental design called for 50 percent of the fry to be held in net pens at the release site for one week and for the remaining fry to be dumped at the release site on the same day the net penned fry were released. Each of these groups was marked with a distinctive coded-wire tag for later identification. Results of these experiments will be available when the adults return after five or more years.

McGregor River Egg Collection and Incubation

In 1982, chinook stock from the McGregor River system was chosen for incubation at the Penny hatchery. Emphasis was placed on James Creek, a tributary of the McGregor River used for spawning by chinook. A total of 203,622 chinook eggs were transported by helicopter to the Penny hatchery in late August. Final incubation and rearing of these eggs will occur from January through July 1983.

In the summer of 1982, a new five-year lease was negotiated with the property owners for occupancy of the land and building associated with the Penny pilot hatchery.

Contact: Robin Dickson, Stock Enhancement Officer; Gordon Bérézay, Technical Support Biologist, Enhancement Operations.

Nechako River Feasibility

This excellent site will not be developed until the future of Alcan's Kemano Completion is known.

In the interim, however, an application has been made for the transfer and administration of Crown land required for the construction of proposed enhancement facilities, and a water licence has been applied for.

Contact: George Nielsen, Senior Project Engineer, Engineering.

Stuart River Pilot Hatchery

After a year's lapse in operation due to funding difficulties, this pilot facility was again operated in the fall of 1982 (see details provided in section on Central Interior Special Employment Initiative).

Contact: Don MacKinlay, Design Biologist; Robin Dickson Stock Enhancement Officer, Enhancement Operations.

Provincial Status Report

Projects are primarily located in the Lower Mainland portion of this region. They are designed to improve stocks of steelhead and anadromous cutthroat trout in streams, and to provide a variety of angling and other recreational opportunities associated with these fish. In addition to harvest regulations and habitat management, hatchery stocking and improvement of in-stream habitat are used to increase numbers of steelhead and cutthroat.

One biologist and three technicians, with occasional assistance from other Fish and Wildlife sections and job creation programs, carried out a variety of projects in 1982.

Hatchery Program Assessment/Maintenance

Hatchery programs for the annual

stocking of steelhead and cutthroat fry or smolts presently exist, or are being started, on 15 systems in the Lower Mainland. Six hatchery facilities (one provincial and five federal) culture fish for these programs.

a) Hatchery Program Assessment

This project continues work that was started three years ago to examine the success of stocking of hatchery steelhead and cutthroat into the following Lower Mainland streams: summer steelhead in the Capilano, Seymour, Coquihalla, and Silverhope Rivers; winter steelhead in the Capilano, Seymour, Vedder, Alouette, Squamish, and Nicomekl Rivers; and anadromous cutthroat in the Serpentine, Little Campbell, Brunette, Stave, and Fraser Rivers, and into the Nicomen and Hope/Camp Sloughs.

The objectives of this project are to determine:

- survival and behavior of juvenile hatchery fish
- size and behavior of adult hatchery returns compared to theoretical predictions for return
- contribution of hatchery fish to anglers' catch, and the effect that hatchery fish (and the hatchery program) have on angler use.

A variety of techniques including angler surveys, juvenile fish population estimates, adult fish swim surveys, and spawner/redd surveys are used to meet objectives. Angler surveys are carried out from December to May for winter steelhead runs; July to October for summer steelhead runs, and October to May for cutthroat. Additional information is provided by an angler logbook program, in which anglers keep their own detailed records for submission and analysis at the end of the season. On-stream surveys are considered very important not only because they produce management data, but also because they provide an opportunity for communication between anglers and fishery management staff.

During 1982, the following conclusions were made about the hatchery program.

i) Summer Steelhead

- Coquihalla River had an average return of wild steelhead but a very poor return of hatchery fish. A special, closely monitored two-month fishery produced angler use data similar to the previous year, but the catch of hatchery steelhead was down by 50 percent. A pre-season Floy tagging of adult fish, with post-season recapture, provided data for estimating the run size at 243 fish, down from previous years owing to poor hatchery returns.
- juvenile population studies in 1982 estimated that the fry rearing capacity of the Coquihalla mainstem had decreased. They also indicated that toxic discharges from a gold-processing mine on Ladner Creek had reduced the numbers of juvenile fish using the river
- in Silverhope Creek, juvenile population estimates of previous years were continued to determine the survival of wild and hatchery fish (fry stocking). High water levels made sampling difficult and may give results less reliable than those obtained in past years
- Capilano River returns of hatchery summer steelhead during 1982, were the best in many years. These hatchery fish have increased by 50 to 70 percent the anglers' catch of summer steelhead.

ii) Winter Steelhead

- some streams with hatchery-produced winter steelhead runs have had adult returns for several years. Generally, these returns, while considerably less than the anticipated returns, are nevertheless contributing strongly to the angler catch
- in the Alouette River, hatchery fish compose 50 to 70 percent of the anglers' catch. Angler use of the Alouette River is increasing
- Vedder River hatchery fish constitute 8 to 15 percent of the anglers' catch. These fish appear to return

early in the season to release sites as intended. Swim surveys and the angler logbook program indicate that the wild run of fish during 1982 was very strong. Residualization of hatchery smolts for some time after stocking continues to be high

- in the Nicomekl River, hatchery steelhead make an increasing contribution to the anglers' catch. More steelhead also occur in Mud and Semiahmoo Bay tributaries. An enumeration fence, operated by the Semiahmoo Fish and Game Club on the Little Campbell River recorded over 200 steelhead heading upriver during the 1982/83 run. Some 30 percent of these fish were hatchery fish that had strayed from the Nicomekl River
- Ashlu Creek (Squamish River) fry stocked into habitat above a barrier on the mainstem, continue to be monitored. Three year-classes of hatchery juvenile fish are now present. It has not been possible to monitor the rate of survival each year
- juvenile steelhead/habitat work in preparation for new hatchery programs was done on the Cheakamus, Chehalis and Little Campbell Rivers.

iii) Sea-run Cutthroat

Angler surveys, including an angler logbook program continued, with emphasis on streams that have been stocked with hatchery cutthroat smolts. These hatchery fish appear to distribute widely around the release site either shortly after release or when they return from river estuaries or marine areas as older, larger fish. Hatchery fish contribute substantially to the anglers' catch (20 to 66 percent), depending upon the angling location. The overall catch of cutthroat checked in angler surveys remains low. The larger proportion of hatchery fish to wild fish in the catch further suggests that wild stocks of cutthroat are not numerous. Very restrictive harvest regulations remain in place in order to increase spawner escapement.

Between October 1982 and February 1983, 220 anglers who were checked had caught 290 cutthroat trout. Forty-six percent of these fish were of hatchery origin.

b) Hatchery Program Maintenance (Brood stock capture

Hatcheries that supply steelhead and cutthroat smolts and fry for stocking depend on an annual supply of brood stock. Fish and Wildlife policy is to use native, wild brood stock for most hatchery stocking programs. These fish are most effectively supplied by Fish and Wildlife staff using angling (steelhead) or electrofishing (cutthroat) techniques. In 1982, brood stock was captured from the Alouette, Squamish and Chehalis Rivers.

The objectives of this project are to supply wild steelhead/cutthroat spawners in good condition to provincial and federal hatcheries in sufficient numbers to satisfy production and adult return goals for several river systems.

Capture of brood stock in the Lower Mainland area is a shared responsibility between provincial management, research, and fish culture staff. In some cases, assistance is supplied by federal fish culture staff, volunteers from steelhead angling groups and job creation programs.

Steelhead brood stock for the 1982 brood year were obtained from the Alouette, Squamish, Silverhope, Coquihalla, Capilano and Seymour Rivers, as well as Marshall Creek and Mud Bay streams. Cutthroat were obtained from the Fraser River and Mud Bay tributaries.

More than 150 days of effort were expended to obtain 119 winter steelhead, 110 summer steelhead and 187 cutthroat. Capture or holding mortality was less than 5 percent. Assistance was provided to hatcheries during stocking of steelhead and cutthroat fry and smolts on some rivers.

Habitat Improvement/Biophysical Survey

The effectiveness of boulders placed in Scott Creek, a tributary of the Coquitlam River, and in Bear Creek, a tributary of the Serpentine River during previous years was assessed. These boulder clusters provide increased habitat for young trout and salmon during periods of both high and low water. Clusters of larger boulders are more durable than clusters of smaller boulders. Juvenile trout are using this new habitat more often than they do untreated areas of the streams.

In 1982, retreatment with boulders was carried out on both creeks to repair boulder loss that had occurred over the winter. On Scott Creek, additional areas of the stream were treated.

A number of other streams in the Mission, Maple Ridge and Matsqui areas were examined for habitat improvement potential and possible work in 1983. Draper Creek near Mission and McKay Creek in North Vancouver were considered to be good candidates for boulder placement.

In response to habitat management needs for fisheries data, about 20 small streams were surveyed throughout the Lower Mainland. This included a basic habitat overview and sampling of fish stocks present.

Contact: Peter Caverhill, Fisheries Biologist, Fish and Wildlife Branch, Surrey.

Chilliwack/Vedder River Steelhead

The combined efforts of Chilliwack River hatchery and the Fisheries Research Section in Abbotsford produced a steelhead smolt plant of 67,000 in May 1982. The smolts averaged 107.1 grams in weight. Parents of the 1982 release were native Chilliwack/Vedder early run fish. These fish were a mixture of 2 and 3-year-ocean fish, with the latter predominating.

All eggs obtained from these adults were incubated at the Fraser Valley trout hatchery. The fish were then reared to a weight of six to 10 grams, tagged, and delivered to the rearing channel at Chilliwack River hatchery.

An additional 19,490 smolts weighing an average of 65.7 grams were released into Salwein Creek, a tributary of the lower Vedder River. This release consisted of two identical groups of smolts, the only exception being that 10,182 fish were hatchery-reared, whereas the remaining 9,308 were reared in net pens in Salwein Creek. This release should provide a good comparison of the two rearing techniques.

At present, Chilliwack River hatchery is rearing 70,038 pre-smolt steelhead. These fish wre incubated and reared to the three-gram size at the research facility at Fraser Valley trout hatchery and delivered to Chilliwack River hatchery. In addition, 10,000 steelhead are being reared in net pens in the Vedder bridging pond near the Chilliwack Armed Forces base. All smolts will be released in May 1983.

Vedder/Chilliwack steelhead production for the 1984 releases will consist of 125,000 smolts and 100,000 fry. The Fisheries Research Section will assist in the smolt program with incubation and early release of 70,000 fry. These fish will be delivered to Chilliwack River hatchery by late July at a weight of about four grams.

Contact: Bob Land, Research Technician, Fraser Valley Trout Hatchery, Abbotsford.

Nicolum Creek Habitat Assessment

Nicolum Creek, a tributary of the Coquihalla River is being evaluated for steelhead enhancement.

In an effort to rebuild a diminished winter steelhead population Nicolum Creek was identified as a possible candidate for headwater stocking. Headwater stocking of fry has proven that rearing habitat can be more fully utilized and has shown considerable promise as an enhancement tool.

The steelhead population now rearing in the lowest reaches of the mainstem Coquihalla River contributes too few adults to the fishery. Any significant increase in juvenile production and adult returns would mean immediate benefits, since the Nicolum and lower Coquihalla are within easy driving distance for Lower Mainland anglers.

Habitat assessment and a juvenile salmonid census were carried out in 1982. Habitat inventory was conducted by standard methods and estimated using stream variables such as velocity, depth, and substrate. In September 1982, a population census (total removal) was conducted by electroshocking at four index sites.

Nicolum Creek has a major obstruction situated in a narrow, bedrock canyon near the stream's confluence with the Coquihalla River.

Two reaches above the obstruction located 1 km upstream of the confluence with the Coquihalla River were described with respect to usable habitat. The channel gradient is high (> 3.4%) in most sections of the stream except reaches 2 and 3. In these two reaches, suitable areas for fry and parr were located. However, the confined channel width, high low-flow discharge (> 30 percent mean annual discharge) and high mean gradient (1.9-2.8 percent) limit the probability of use by steelhead fry. High velocities (up to 80 cm/sec) and large mean depths (> 0.5 m) reduce the fry-carrying capacity to about 11,000 fish during the summer. Reaches 2 and 3 have a combined total length of 6.5 km and a wetted area of 66,800 square metres. Mean fry density is about 0.16 fry/m^2. The Slaney smolt model (1981) predicts a mean steelhead parr density of 0.17 parr/m^2 and total annual smolt yield of 4,490 smolts. Given the underseeded nature of the stream and the highly limited fry habitat, only 1,540 wild smolts are expected to be produced annually and the mean adult return should be near 200 fish. With a catch/escapement ratio of 1:1, the annual catch increase in the lower Coquihalla River should be 100 adults.

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Coquihalla River (Summer Steelhead) Rearing Capacity Assessment

The Coquihalla River study in 1982 included:

- release of 40,000 Coquihalla steelhead fry, averaging 1.2 g, incubated at the Fraser Valley trout hatchery, into the river
- assessment of low-flow fish densities and habitat use
- comparison of fish densities between years
- comparison of adjusted mean fry densities (wild fish only) with estimated spawner escapement
- evaluation of hatchery fry releases by interpretation of significant gains in fish abundance.

The results of the trial saturation of hatchery fry into a wild environment will provide guidelines for future fish management. This may be accomplished by a better understanding of the necessary spawner or recruitment numbers to fully seed the stream and to maximize smolt yield and adult returns.

As a follow-up to the 1981 investigation in which high fry densities were documented (mainly as a result of an exceptionally good spawner escapement in 1980), a larger fry release was authorized to corroborate the earlier findings. More effort (a larger sample size) was spent on qualifying changes in yearling abundance as a result of the 1981 fry plant, the exceptional wild fry recruitment, and the severity of winter floods. Fifteen lots of 2,740 fed fry, weighing 1.2 g each, were released at selected index stations on July 22.

Population estimates at 15 index stations were completed by total removal electroshocking. Conditions for the census were ideal, with stream flow near 4.5 m^3/sec (160 cfs) at the Sowaqua bridge and good water transparency. Preliminary analysis of field data was completed for this report. Since the hatchery fry could easily be distinguished from wild fry by size analysis, a Petersen mark-recapture estimate was also made to qualify the probable (total) fry stock and compare this estimate to values generated by useable habitat measurements.

Fry abundance by virtue of stocking and natural recruitment was considerably greater in 1982, compared to 1977 to 1980, but was nearly identical to 1981 data. This apparent consistency of fry densities with habitat use indices in 1981 and 1982 may be construed as the attainment of low flow carrying capacity. Lack of a strong, fish abundance/habitat relationship based on data (prior to 1981) was probably due to underseeding conditions. By means of three separate methods for predicting maximum fry stock, it appears the Coquihalla River may be able to sustain up to 135,000 steelhead fry.

Wild fry populations numbered 26,000 - 53,000 fish between 1977 - 1980 and these numbers have been consistent with low spawner numbers (133 - 163 spawners) and potential egg deposition (246,000 - 302,000 eggs). The estimated minimum escapement necessary to fully seed the stream is about 350 adults. Unfortunately, the high fry densities observed in August 1981 did not translate into the anticipated high yearling abundance in 1982. While there were four index stations whose yearling densities (0.12 - 0.18 fish/m^2) were the highest recorded, the adjusted 1982 mean was not significantly different from that obtained in other years. This occurred, despite the excess parr capacity and the lack of any major flood between August 1981 and August 1982 to account for increased mortality and lower yearling densities.

The high boulder abundance in the stream and the stream's riffle/run/rapid nature should promote a larger number of steelhead parr. A preliminary parr/habitat model (Slaney, 1981) suggests a parr capacity of 69,000 fish, which translates to an average annual yield of 44,200 smolts. However, the limited fry habitat when fully seeded will likely yield closer to 18,600 wild smolts. This lower estimate should produce 3,500 adults (including repeat spawners) with an escapement of 900 adults.

A continued juvenile census in August 1983, should provide the necessary evidence of increased yearling abundance given the larger numbers of fry in 1982. Since most wild smolts leave the stream after three years and return as adults at age five, the lag time is five years. This means the large fry abundance observed in 1982 will contribute to the sport catch in 1987.

In 1983, some 60,000 fed steelhead fry (Coquihalla River stock) are to be released in late July coincident with wild fry emergence. The stocking program assessment will be continued, with more effort to be spent on qualifying changes in yearling (age 1+) and parr (age 2+) abundance as affected by the 1981 and 1982 fry plants. With an estimated spawner stock of 178 adults in 1982/83 and the (scheduled) fry plant, the total recruitment should be 126,000 fry in 1983. This number is reasonably close to the estimated saturation of the available rearing habitat in the mainstem.

Contact: Ron Ptolemy, Fisheries
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Nicola River Fisheries Assessment

The Nicola River system supports significant but severely depressed stocks of steelhead, chinook, coho and pink salmon. Recent conflicts between industrial, agricultural, and domestic water users have caused concern over low summer flow problems in the Nicola Valley. As a result, local interest groups originally promoted a major water use study, undertaken by Y. Bajard Associates Ltd. The Ministry of Environment chose the Nicola basin as a priority area for the development of a strategic management plan. The Nicola fisheries assessment project was designed to determine the potential for restoration and improvement of salmonid streams in the watershed and was intended to last for three consecutive years from 1980 to 1982. Study objectives were to:

- identify the distribution and relative importance of salmonid spawning and rearing areas in the mainstem and major tributaries through a census of juvenile fish
- relate existing production to habitat capabilities and constraints while identifying enhancement opportunities for salmonids
- improve efficiency of deepwater sampling in the mainstem
- investigate theories on mass downstream migration of chinook and steelhead presmolts during the summer period
- monitor natural variability in fish populations through an indexed sampling approach
- sample fish during September at 31 or more sites in the mainstem and tributaries. Only four of the 31 sites were new in 1982, and they replaced former index sites that could no longer be sampled.

Initial review of the data suggest that:

- underyearling chinook densities and distribution were significantly greater in 1982 than in the two previous years. This may reflect considerable variability in either egg-to-fry or presmolt survival and/or partial but early outmigration
- steelhead fry numbers in 1982 appeared to be low, despite predictions of increasing fry populations based on higher-than-average adult returns indicated in the 1981 Thompson River angler creel census. The distribution of fry was similar to results obtained in the two previous years
- steelhead parr populations in 1982 appeared to be similar to results obtained in the two previous years
- coho fry numbers and distribution in 1982 were greater in Spius and Maka Creeks than in the two previous years.

Contact: Dale Sebastian, Fisheries
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Outplanting Opportunities for Salmon in Selected South Thompson Tributaries

In 1981, DFO's New Projects Unit outlined a program to assess habitat and juvenile salmon stocks in the South Thompson River system. The program's goal was to provide biological and physical information for use in planning and implementing salmon enhancement facilities. Initial investigations in 1981 by EVS Consultants involved baseline biophysical studies of the Eagle, Salmon, Adams and mainstem South Thompson Rivers. Subsequent studies were to focus on determining underutilized rearing capacities for chinook, coho, (and steelhead) in 18 South Thompson tributaries. In 1982, the Fish Habitat Improvement Section (FHIS) of the Fish and Wildlife Branch was contracted by DFO to investigate six streams; namely, the Seymour, Perry, Crazy, South Pass, Tappen and Trinity tributaries. Specific objectives of the study were:

- to determine the actual and potential numbers, size and age of juvenile salmonids rearing in the six streams
- to characterize the streams and to inventory habitats in relation to their utilization by salmonid fry
- to assess water temperature and flows, and to determine water quality in order to assess potential limits to rearing of salmonids

- to submit a final comprehensive report on the methods and results, including the implications that the results may have for proposed enhancement techniques such as salmon fry stocking.

Fish and habitat assessment was conducted at 58 sites in 24 reaches of the six tributaries. Initial aerial surveys of the Seymour, Perry and Crazy systems were made by helicopter in July 1982. Habitats were assessed on-site from mid-July to October, using standard FHIS methodologies. Snorkel surveys were conducted on lower reaches of the Seymour, Crazy and McNomee systems, three short sections of the Eagle River and a mid-section of the Perry River. Extrapolation of sample site information to achieve population and standing crop estimates was produced on a reach-specific basis.

Chemical analyses for extractable metals, mercury, nutrients, residues, water hardness, and other general characteristics were completed on four sets of samples collected monthly from each stream during July to October. The samples were compared with water quality criteria for salmonid hatcheries.

In 1982, the larger streams were relatively unproductive for salmon due to high gradient velocity and relatively cold water. Potential for chinook production (about 7,000 adults before harvest) was limited to lowest gradient sections of the two largest streams, the Seymour and Perry Rivers. Estimates of potential smolt production for chinook, however, are theoretical in view of limited information available on stock-specific life histories. Coincidental catches of juvenile chinook in the Eagle River during October 1982 indicate that extended rearing (i.e. overwintering) in nursery streams may be important for smolt production. Local habitat, however, may not limit chinook production if chinook fry migrate downstream immediately following emergence, as some have suggested. A better understanding of the importance of extended stream rearing on chinook smolt production is required.

Most streams were estimated to have some potential for increased coho production and could be realized through fry outplants and/or on-site incubation facilities. The total potential for coho production was estimated at 5,200 adults before harvest, from an annual production of 35,000 smolts. Implications from the 1982 studies are that further investigations to determine coho potential in the South Thompson area be concentrated on smaller, relatively low gradient streams (i.e. mean annual discharge < 3 m^3/s, gradient < 2 percent).

All study streams were judged to have reasonably good water quality for fish production. Relatively high concentrations of nonfilterable residues ($\geq$ 32 mg/L) in Tappen Creek may be of concern in the development of salmonid embryos, if on-site egg incubation facilities are developed. High total dissolved solids (TDS) in Tappen and Trinity Creeks (235 and 180 mg/L, respectively) suggest relatively high potentials for primary productivity and generally productive environments for fish.

There is presently no evidence to suggest that steelhead move upstream through Kamloops Lake, although ideal habitats exist in both the North and South Thompson Rivers and their tributaries. Low densities of rainbow trout fry relative to older age groups suggest that resident stocks in study streams are currently limited by fry recruitment, particularly upstream of obstructions. It appears there is potential for increasing trout production in most study areas, although this may reduce the potential for producing coho and chinook salmon through increased competition for food and space.

Contact: Dale Sebastian, Fisheries Biologist, Fish Habitat Improvement Section, Fish and Wildlife Branch, Victoria.

Deadman River Brood Collection Fence

This fence was constructed in the Deadman River adjacent to property owned by the Allan Ranch.

In the previous years, hundreds of hours were spent angling for steelhead brood stock in the Deadman River. Most brood fish obtained were already partially spawned and not in prime condition. A temporary broomstick fence was installed in spring 1982, and seven steelhead were captured in it before it was washed out by flood waters and debris.

A permanent fish fence was built in the fall 1982. It provides the opportunity to obtain brood stock two weeks prior to spawning, when the fish are in excellent condition. This fence also permits Fisheries staff to collect biological data and obtain estimates on steelhead escapement. In the past, escapement estimates were obtained by helicopter and on-site counts. Resident populations of rainbow trout migrate into the Deadman River from the Thompson River. The fence will be used to capture these trout for tagging in order to learn their life history and determine their abundance.

Contact: Ian McGregor, Fisheries
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Deadman River Habitat Improvement

The Deadman River has been identified as a key spawning and rearing area for Thompson River steelhead. Defoliation of the stream banks (a result of agricultural practices) has caused serious erosion and temperature problems; in turn, this has resulted in a substantial loss of rearing habitat for juvenile steelhead.

Cattle feeding and watering near the stream trample trout redds, or nests, and disturb spawning fish. For example, in one area, adjacent to the Docksteader Ranch, approximately 30 pairs of steelhead spawn each year. This spawning area is also used as a cattle crossing, resulting in further habitat degradation. Objectives of this project are to fence off key spawning habitat, to revegetate portions of the Deadman River and to provide proper cattle crossings by bridging and fencing.

In 1982, several native tree and shrub species were identified as suitable for revegetation. These include red osier dogwood, Douglas maple, willows, rose bushes, and hawthorn. These species were selected for several characteristics: the complex root system provides streambank stability, they provide shade, they are not palatable to cattle, and their maximum height does not exceed seven to eight metres, as ranchers are concerned with excessive shading of their fields.

Five kilometres of fencing was purchased in 1982, and a key property along the Deadman River will be fenced in 1983 to exclude cattle.

Contact: Ian McGregor, Fisheries
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Population Assessment of the Deadman River

The Deadman River has been identified as a key spawning and rearing area for Thompson River steelhead. Previous assessment and observation have indicated that a major portion of the steelhead run spawns in the Docksteader Ranch area.

A serious flash flood in August 1982 caused irreparable damage not only to fisheries habitat, but also to agricultural land. The Docksteader Ranch lost approximately 12 ha of land. At the same time, stream gradients increased, and valuable spawning gravel was lost. (High flows "flush" fry out of the system.)

Objectives of the 1982 assessment were:

- to determine the effect of the flood on rearing salmonids
- to assess the damage of stream diversity in both foliated and defoliated areas
- to determine effective methods to maintain stream integrity.

In 1982, a complete fisheries assessment of the Deadman River was conducted, including an assessment of all resident and anadromous fish. An effort was made to duplicate 1979 sample sites so that comparisons of results could be made. Preliminary analysis indicates that a large portion of the salmonid population was either forced or migrated out of the Deadman River system.

Contact: Ian McGregor, Fisheries
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Thompson River Creel Census

Historically, the Thompson River has supported one of the largest natural runs of summer steelhead in B.C. The large size and superb fighting quality of these steelhead have brought acclaim to the Thompson River sport fishery. Anglers come from all over B.C., as well as from Alberta, Washington, Oregon, and Europe.

Data collected for the six years prior to 1982 have proved invaluable in the management of Thompson River steelhead. Since 1976, angler effort has doubled and the catch tripled. Accordingly, regulations have been changed to offset the popularity of this fishery. Catch limits have been reduced from two fish per day and a six-fish possession limit to one fish per day and a two-fish possession limit. The steelhead season has been reduced from seven months to three months, and all tributaries are now closed to angling.

A creel census was conducted on most weekends in October, and daily in November. Checks were not conducted in December as a result of funding constraints. A report of creel census results is in preparation.

Contact: Ian McGregor, Fisheries
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Spius Creek Holding Tanks

Because Loon Creek hatchery does not have the capacity for both Deadman River and Spius Creek steelhead, alternate means of holding brood stock were examined. In 1981, fish were held in the Nicola River, but complications arose and the fish had to be transferred to Loon Creek hatchery. Brood stock collection will be simplified in 1983 following the installation of a small holding facility near Spius Creek, a tributary of the Nicola River. A private landowner has agreed to allow the Fish and Wildlife Branch to put two adult holding tanks on his land and to act as watchman. As steelhead ripen, they will be spawned and the eggs transported to Loon Creek hatchery for incubation.

Contact: Ian McGregor, Fisheries
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Branch, Kamloops.

Brood Stock Collection and Fry Releases

Brood stock collections have been ongoing in the Deadman River since 1979, but 1982 marks the first year that brood stock has been collected in Spius Creek and the Bridge River.

Spius Creek, a tributary of the Nicola River, has been identified as a stream with excellent potential for salmonid enhancement. According to historical records, Spius Creek and its tributaries has had a large run of steelhead, but this run has diminished to about 100-150 fish. Spius Creek is the only stream in the Nicola watershed that does not have water withdrawal problems and it is virtually unlicenced for future water demands.

Maka Creek, the most productive tributary of Spius Creek, suffered severe damage from fires during the late 1960s and early 1970s. The system is now reforesting and stream habitat is being slowly restored. Initial enhancement effort is designed to rebuild the depleted Maka Creek steelhead run.

The Yalakom River, a tributary of the Bridge River, was once productive for steelhead, but is now dammed by a hydroelectric project. The Bridge River still has a small run of steelhead which has the potential to colonize the Yalakom River.

Once a steelhead run is established in the Yalakom River, it is hoped that an obstruction blocking access to the upper watershed will be removed.

Brood stock collected in 1982 included: 12 females and six males from Deadman River, 14 females and three males from Spius Creek, and four females and one male from Bridge River.

In August 1982, 38,000 fry were released by scatter-planting, using helicopters and trucks, into Spius and Maka Creeks.

In September, 4,000 fry were released by scatter-planting, using helicopters and trucks into the Yalakom River.

Deadman River stock was raised to smolt size in Loon Creek hatchery and will be released in 1983.

Contact: Ian McGregor, Fisheries Biologist, Fish and Wildlife Branch, Kamloops.

Bonaparte River Steelhead and Chinook Release Assessment

The Bonaparte River drains Bonaparte Lake located 70 km northwest of Kamloops. The Bonaparte enters the Thompson River at Ashcroft.

In 1979, the salmonid rearing capacity in the Bonaparte River was evaluated in relation to proposed SEP activities. These plans included blasting the Bonaparte River falls to allow anadromous salmonids access to over 140 km of underutilized habitat, and development of steelhead and chinook production capability at Loon Creek hatchery. The first chinook and steelhead production from this facility was available for release in the spring, 1981. Release sites in the Bonaparte River were identified and the success of the releases in terms of juvenile rearing and growth was evaluated.

Results of the 1981 evaluation indicated that the stocking program was successful.

In 1982, chinook and steelhead were again stocked in the river, and an assessment of rearing in the Bonaparte River was made.

Release sites were chosen in consultation with Loon Creek hatchery staff. Roughly 34,000 steelhead smolts were released in April at seven sites in the Bonaparte River between Cache Creek and the Rayfield River. Stocking methods included scatter releases and point releases. Approximately 700 steelhead smolts were released in the lower Bonaparte River below the falls near Ashcroft. Roughly 52,000 chinook fry were scatter-released in April at two sites.

Population estimates were conducted at 20 sites along the Bonaparte River from Young Lake to Ashcroft during October 1982. Emphasis was placed on sampling at and near release sites. All population estimates were conducted by electrofishing. Chinook and steelhead scale samples were collected at the times of release and capture.

Preliminary results indicate that both steelhead and chinook were less abundant than in the previous year. Significant problems were encountered in sampling due to high water flow in 1982.

Contact: Dave Tredger, Fisheries Biologist, Fish Habitat Improvement Section, Fish and Wildlife Branch, Victoria.

Chilcotin River Steelhead Enhancement

Fry stocking has been identified as a major enhancement technique for Chilcotin River steelhead. Prior evaluation of the stream system suggested that emphasis of a fry stocking program be directed at the Little Chilcotin River. In August 1982, 34,000 marked fry were released and post stocking assessment was conducted in October 1982.

The marked fry (flourescent dye) were released at a predetermined site on August 27, 1982. Population estimates by electroshocking were conducted at 12 sites over a stream length of 2.7 m (0.1 m above to 1.3 m below the release site). All rainbow fry captured were examined for marks using a portable ultraviolet light.

Of 368 rainbow fry captured, 253 (69 percent) were marked. Marking loss in hatchery fish was estimated at 12 percent. The actual number of hatchery fry was roughly 323 (88 percent) of all captures. The overall mean saturation density of steelhead fry in the sample area was estimated at 1.62 fry/m of edge habitat (3.24 fry/m of stream).

Hatchery fry had grown 7.5 mm in length and 0.40 g in weight from release to capture, a period of 38 days. Growth was low compared to that of some Lower Mainland hatchery releases. The predicted growth of hatchery fry, based on wild fish growth, suggests a smolt age of two and three years.

Based on the saturation fry density, the stocking rate in the Little Chilcotin River (which contains good steelhead habitat only below Chilcotin Lake) was revised to 4.7 fry/m of stream. Total fry requirement for the Little Chilcotin River was estimated at 110,000, with 75,000 in the prime area below Chilcotin Lake, and 34,000 in the "second choice" area above Chilcotin Lake.

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Wildlife Branch, Victoria.

Chilcotin River Steelhead Stocking

Historically, the Chilcotin River supported a popular steelhead sport fishery. In recent years, however, steelhead stocks in this river have declined and the harvest by anglers has therefore been restricted. The poor adult returns have resulted from mixed stock commercial fisheries on the coast, and overharvesting by sport anglers.

In 1981, a pilot steelhead fry production and stocking project, using a makeshift hatchery, was undertaken on the Chilcotin River system. Approximately 14,000 fry, averaging 1.0 g in weight, were released in the Chilko River. In addition to the fry stocking program, angler catch and spawning escapements have been determined annually by a creel census and helicopter counts.

The Chilcotin fry stocking program was continued in 1982 using the same hatchery facility located at Hanceville. Adults were collected from the Chilcotin River in April, held in isolation boxes and spawned in June. Prior to release, steelhead fry were spray-marked with fluorescent grit so that wild and released fry could be differentiated during post stocking assessment. Fry densities and growth at the release site were surveyed during October.

Steelhead escapements to the Chilcotin system were assessed by performing aerial counts of spawners in the Chilko River during May. A creel census was also undertaken to provide data on run size and angling effort/success.

A total of 44,000 eggs were obtained from five female Chilcotin steelhead. Approximately 34,000 fry, averaging 0.9 g in weight, were released into a 1.2 km section of the Little Chilcotin River in August. The aerial count of steelhead in the Chilko River in May was 195 adults. Total escapement to the system was estimated to be in the order of 700-1,000 fish.

Between October 10 and December 31, 1982, 321 angler-days were spent in the Chilcotin system and 135 steelhead were landed of which 85 (63 percent) were released.

Contact: Jack Leggett, Fisheries Biologist, Fish and Wildlife Branch, Williams Lake.

Job Creation Projects

Brunette River Improvement Project

The Sapperton Fish and Game Club sponsored this project to enhance salmonid production and management on the Brunette River. Nine people completed the following work:

- modification and reconstruction of the Stoney Creek fishway which enables coho, steelhead and cutthroat trout easy passage through a culvert and access to 5 km of good rearing habitat
- construction of fishways (step pools) for salmonid passage over two concrete weirs on Stoney Creek
- concrete removal, shot rock placement and selective clearing of bank vegetation on Stoney Creek
- debris removal from the whole watershed
- development of a seepage pond for future fish culture by removal of snags and clearing of the outlet creek
- public information program on deleterious spill avoidance by door-to-door leaflet distribution
- creel census
- spawning ground counts
- construction of 36 holding tubs for volunteer projects on the Brunette and Squamish Rivers
- collection of 20,000 coho eggs from Salmon River stock to be incubated and reared at Alouette, and then planted in the Brunette River
- collection of approximately 10,000 coho eggs for a volunteer project at Squamish
- construction of a lead-in fence for an experimental fishway on the Cariboo Dam.

Surrey - Langley Stream Enhancement

Nine people were employed on this project to increase salmonid production in the Serpentine, Nicomekl and Little Campbell Rivers. Initially, these watersheds were mapped to identify spawning, rearing and holding areas. Various habitat improvements were then undertaken: logjam removal, urban debris removal, stump and boulder placement for cover and pools, gravel placement, bank stabilization (securing logs and placing rip-rap), ditching of side channels to compensate for low flows and fish passage improvements at culverts and pipeline crossings.

Life history work included monitoring of salmonid escapements for the Field Services Branch. Scales were taken, fish lengths were measured, and fecundity and sex were recorded. Fence counts by the Semiahmoo Fish and Game Club on the Little Campbell River will be compared to these field counts to establish a counting efficiency index for similar Lower Mainland streams. Coho, chum, chinook, steelhead, and cutthroat stocks were all monitored.

In addition, a redd life assessment of coho salmon was undertaken. (A redd life assessment is a behaviorial study whereby a particular spawning pair is observed from the time the redd is constructed, through the spawning procedure, to abandonment. The number of redds, behavior, timing, predators, spawning substrate, water conditions, etc. are recorded. The important factor is: how long does it take for the spawners to establish the redd, complete spawning, and die? These data help refine population estimates that are made from spawner counts.)

The crew also rebuilt an aerator at the Surrey Fish and Game Club's incubation box on the Serpentine Fenn.

Coquitlam River Enhancement Project

Up to 61 people were employed on this project working out of the Port Coquitlam Hunting and Fishing Club on Burke Mountain in Coquitlam. A wide variety of work beneficial to salmonids was accomplished.

Life history studies of coho, chum, steelhead, and cutthroat trout in the entire Coquitlam watershed included dead pitching, sex and age sampling, live counts, Petersen disc tagging, fin marking, construction of a floating broomstick fence, adult and fry trapping and repetitive seining. Data will be provided to DFO and Fish and Wildlife biologists to help plan an enhancement strategy for the Coquitlam River. Habitat authorities from both governments also use such data to deal more effectively with urban development and diversion proposals.

Intensive stream bank reforestation was completed on the banks of Terry Fox, Maple, Scott and Hoy Creeks. A wide variety of conifers, grasses and deciduous shrubs and trees were planted to stabilize soils and to provide cover. Each planting is suited biologically and physically to the particular area.

Four 50,000-egg incubation boxes were constructed and installed on Slade Creek, a small tributary of the Coquitlam River. Some 4,000 coho eggs collected by project members were planted in one of these boxes, and flows and water quality were monitored to test the site for future use. A settling box installed on the water intakes has kept the boxes relatively free of silt.

The Kanaka Creek fish fence was also modified and operated. Fish counts were conducted and coho and steelhead brood stock were collected for incubation at volunteer and Fish and Wildlife projects.

Central Fraser Valley Salmon Spawner Enumeration

Five people were employed as support staff for the Coquitlam subdistrict fishery officer. Spawner enumeration, fishery monitoring, enforcement patrol support and equipment maintenance assisted the fishery officer to manage the resource more efficiently.

Blockages, beaver dams, and urban debris were removed from the South Alouette, Kanaka, MacIntyre, Blaney, Laurentian, Hoy, and Scott Creeks providing good access for all anadromous spawners.

Semiahmoo Hatchery Support

The Semiahmoo Fish and Game Club complemented their fish fence operation on the Little Campbell River by sponsoring a project to construct a small hatchery and rearing facility adjacent to the fence. It has been designed as a public showcase for use by school groups as well. Seven persons were employed. Specific work included:

- site preparation and levelling
- development of a five-metre well capable of producing 296 l/min
- construction of a pumphouse for the well
- development of a 76-metre well capable of producing 455 l/min
- construction of a 20 X 20-metre settling pond
- construction of a 7 X 17-metre hatchery building, complete with incubation and rearing troughs, a classroom and washroom
- streambank protection near the fence.

In 1983, the hatchery complex will be completed with the installation of pumps and a water distribution system which will include a bio-filter, an aeration tower and an alarm system. An outdoor classroom/picnic area and a nature trail will complement stream improvements which will be undertaken on the Little Campbell River.

No eggs were incubated in 1982, and exact production targets are not yet set for 1983. The Semiahmoo Club plans, however, an ultimate fry production of approximately 50,000 steelhead, 40,000 chinook, 5,000 coho and 5,000 cutthroat trout.

Tynehead Zoo - Serpentine Watershed Project

The Tynehead Zoological Society

sponsored two projects, which employed a total of 11 people, on the Serpentine River in Surrey.

The first project involved a detailed biophysical reconnaissance of a tributary of the Serpentine which flows south through the proposed zoo site. Detailed land surveying and hydrological studies were also completed to determine the location of a possible site for a salmonid incubation/education facility which is to be incorporated into the final design of the zoo. Investigations revealed poor groundwater sources. Options available to date indicate that fish production would be limited by water quality and quantity available from surface intakes on the tributary and/or the mainstem of the Serpentine.

The Society sponsored a second project to complete the same type of biophysical reconnaissance on the remainder of the Serpentine watershed, with less emphasis on potential water sources. Habitat problems, spawning and rearing areas were identified and mapped. Flows were taken biweekly at specified sample points, and juvenile distribution was determined by minnow trapping.

The Society hopes to conduct similar work in 1983. As plans are firmed up for the zoo over the next two years, they hope to install the incubation facility and undertake habitat improvement work throughout the watershed. The work would be presented as part of a salmonid education showcase at the zoo.

Salmon River Enhancement

Nineteen people sponsored by the B.C. Wildlife Federation undertook habitat improvements on the Salmon River in Langley, monitored salmon escapement into several streams in Surrey and provided clerical and patrol support to the Surrey fishery officer. Logjams and urban debris were removed from the Salmon River. Some logs were cabled to the streambank for erosion control and cover at problem spots. The steep-pass fishway at 64th Avenue was upgraded by;

- cutting out old gabions which were "gilling" fish (the wire gabions had lost most of their rock contents and were consequently operating like efficient gillnets) and replacing these with heavy rip-rap and concrete
- creating two jump pools just below the fishway by installation of two rock weirs
- placing rip-rap on the clay banks below the fishway
- rounding off lethal, sharp points at the entrance to the actual fishway.

Spawner enumeration and sex and age sampling were carried out in all streams in the Surrey area that drain into the Fraser River or cross the Canada/U.S. border. The data were passed along to fishery officers and biologists at New Westminster. Two project members worked directly under the supervision of a fishery officer to assist with a harvest census and to patrol for violations of habitat and fishing regulations. One clerical worker coordinated the paperwork and communications for the spawning escapement and patrol crews in the field.

Salmon River Incubation Box

Six people were employed to make various improvements to Joe Hopink's 50,000-egg incubation box. The site is located at the confluence of Union Creek and the Salmon River in Langley. The flood damage to Union Creek was cleaned up and rip-rap on the banks replaced. Landscaping, fence construction and painting have made this an attractive facility. The new intake uses a convoluted, perforated aluminum panel to direct silt away from the intake. Heavy rock was placed for Salmon River flood protection and the main river was directed away from the site.

North Fraser Valley Salmon Enumeration

Five people were employed to collect escapement data and carry out obstruction removal as directed by Field Services staff in the Mission subdistrict. Salmon spawners were enumerated in 59 streams from Whonnock east to Hope on the north side of the Fraser River. Chum spawning was monitored on the main stem of the Fraser River from Mission to Hope. Logjams and beaver dams were opened up on six streams to allow salmon access to upper reaches of these streams. Enumeration of coho and late-run chums will be completed by February 1983.

Clayburn - Stoney Creek Enhancement and Reconnaissance

This project is located in the Clayburn watershed, which flows north through Matsqui and into the Fraser River.

Ten people were employed to improve the habitat and production of coho, steelhead, and cutthroat trout in this system. Initially, biophysical reconnaissance was undertaken to determine habitat problems and spawning and rearing areas. Features were mapped for the entire watershed, and juveniles were sampled for distribution, age and growth rate.

A number of habitat improvements were made: obstructions and urban debris were removed; step-pools were constructed in a chute area; erosion control measures, such as rip-rap and gabion placement, energy deflectors, streamside planting and cattle fencing, were undertaken.

A 50,000-egg incubation box was constructed and installed on the bank of Stoney Creek. A sump was installed at a nearby spring to provide a steady flow of groundwater to the box. Some 5,200 coho eggs were collected from Clayburn Creek and planted in the box.

Adult escapement and sampling was undertaken on Clayburn Creek and other systems in the Chilliwack area, and the data were supplied to Field Services Branch.

Inch, Tenderfoot and Birkenhead Hatcheries Projects

Ten people were employed to work under the general supervision of Bill Foye, manager of the three hatcheries.

All three facilities have recently been constructed or upgraded. Project members cleaned up and landscaped the sites. They assisted with modifications to the fish culture apparatus and took part in all aspects of hatchery operations in 1982.

Chilliwack Hatchery Biological Reconnaissance

Four people were employed to assist Chilliwack River hatchery to complete regular and extra projects. The additional help also enabled the hatchery to approach egg collection quotas. Project members helped with chinook reconnaissance and donor stock capture on the Chilliwack River and reconnaissance of all species in donor streams.

Chehalis River Hatchery Project

Five persons sponsored by the Chehalis Indian Band assisted in hatchery operations in 1982.

One of the participants was available to give tours whenever the public, school classes or other interested groups stopped by. Many did, as the nearby Weaver Creek sockeye spawning channel receives 30,000 visitors each October.

Chehalis Hatchery Support

This project is one of two contracts that the Chehalis River hatchery let for egg-takes in 1982. Eleven people were employed to provide escapement information and/or eggs of chum, coho, and chinook salmon captured from several streams in the northeastern section of the lower Fraser Valley.

Escapement information gathered for hatchery personnel included data on the timing, sex, size, and age distribution of fish from Weaver, Silverhope, Lorenzetti, Big Silver, Jones, Evans (Steelhead) and Squakum Creeks; Chehalis and Harrison Rivers; Channel 1A and Hicks/ Maria Sloughs.

The second contract was to collect eggs from Chehalis and Harrison Rivers and Channel 1A. The progeny from these egg-takes will be released into their natal streams.

Chehalis-Harrison River Project

This project is located on the Chehalis Indian Reserve, which is approximately 35 km east of Mission, on the north side of the Harrison River. Five men were employed to improve coho and chum production. Funding was partially provided by the Chehalis Community Economic Development project.

Logjam removal from a major chum spawning stream enabled the fish to use 200 metres of prime spawning habitat. Coho, steelhead, and resident trout fry were salvaged from intermittant flow areas of Steelhead, Crazy, Suicide, Hicks, Deadmans, and Twenty Mile Creeks and transplanted to sections of these streams with stable flows.

The Ed Leon spawning channel trap was modified to allow more efficient upstream and downstream trapping of chum salmon. The improved counts resulting from this work provide the detailed assessment which is useful in determining biostandards for other channels which cannot be monitored easily.

An infiltration gallery and modified outlet system were added to a groundwater incubation pit on Ed Leon Slough to provide sufficient flow for operation of this facility, which is designed for 500,000 chum eggs. In addition, two new 500,000-egg capacity pits were installed at Log Dump and Billy Harris Sloughs. Some 100,000 chum eggs were placed in each of these three pits. Brood stock was obtained from the neighboring sloughs. Flows and water quality were monitored throughout incubation.

Chum spawner enumeration and some scale sampling were undertaken in 20 streams near the project. These data were supplied to the Mission office of the Field Services Branch.

SEP Training Presentations

An audio-visual technician was employed to develop and edit short video presentations on SEP job creation projects, with special emphasis on the variety of enhancement techniques used. These productions will be available from Special Projects resource library. Portions were to be shown on Cable TV in the Lower Mainland.

Contact: Bill Caspell, Project
Developer, Job Creation Unit,
Special Projects Division.

Seabird Island Indian Band Project

A crew of four people was hired to enumerate chum spawners at four improved side channel spawning areas, as well as several potential development sites in the Upper Fraser Valley.

Adams River Display and Hatchery Site Surveys

The first objective of this project which employed six people was to construct an information display about pilot chinook and coho hatcheries planned for the central interior. This display was built at the Adams River for the provincial Parks Branch which held its "Salute to the Sockeye" attended by thousands of people during October.

The crew has since been involved in conducting topographical and hydrological surveys at two of the proposed hatchery sites; namely, the middle Shuswap River and Spius Creek, a tributary of the Nicola River near Merritt. They have also been involved in construction work at the Eagle River hatchery. This contract also provides for a caretaker/maintenance man to live at this new facility.

North Thompson Indian Band Project

A joint Job Creation/Community Economic Development Program project employing up to six people from the North Thompson Indian Band was established at Chu Chua. Coho enumeration and sampling, juvenile distribution sampling and stream clearance were carried out on various North Thompson tributaries including Dunn, McTaggart, Fennel Creeks, and the East Barrière River. In addition, an upwelling incubation box was installed on the Chu Chua domestic water supply and stocked with 28,000 coho eggs obtained from Dunn Creek stock.

Plans for 1983 include net pen rearing of the coho fry in Dunn Lake and further stream rehabilitation work. Feasibility studies for a Barrière River hatchery have been initiated. Plans call for approval to enhance Barrière River chinook and coho as well as Dunn and Lemieux coho stocks.

Contact: Sam Gidora, Project Developer, Job Creation Unit, Special Projects Division; George Nielsen, Senior Engineer, Engineering.

FRASER RIVER PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1982	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1982 Releases
Nicomekl R.	George Derkson	8	3	incubation	coho	4,000	80	48
Anderson Cr.	Valdemar Kamaldnieks	4	2	stream clearance	—	—	—	—
Archibald Cr.	Archibald Creek Enh. Gr.	1	4	natural fry feeding	—	—	—	—
Salmon R.	Joe Hopink	12	3	incubation, construction	coho	4,000	21	48
Little Campbell R.	Semiahmoo Fish & Game Club	25	5	studies, construction	coho steelhead	Tagging of downstream migrant smolts; captured brood stock for Abbotsford trout hatchery.		
Hyland Cr.	Surrey Fish & Game Club	20	4	stream improvement	—	—	—	—
Serpentine R./ Bear Cr.	K.B. Woodward Elementary School	150	2	incubation in school, construction	coho	Eggs of 1981 brood died due to malfunction of dechlorinator.		

Table 8

Public Participation Projects

Serpentine Fen	Surrey Fish & Game Club	20	4	incubation, stream improvement	coho	2,500	50	30
Union Cr.	Langley Boy Scouts	80	3	stream improvement	—	—	—	—
Willband Cr.	Community Work Service Program	25	1	stream improvement	—	—	—	—
Little Chilliwack River	Skow-Kale Project/ Chance Alternate School	4	2	incubation,	chum	8,000	20	64
				incubation in school	coho	14,000	47	168
					cutthroat	—	—	—
Chilliwack River	Center Creek Corrections Camp	20	2	incubation	chum	38,000	94	760
Chilliwack Area Streams	Chilliwack Senior Secondary School	50	2	incubation in school	coho	—	—	—
					chum	1,200	80	24

Contact: Joe Kambeitz, SEP Community Advisor.

Mossom Creek	Centennial High School	15	7	incubation	chum	51,000	78	408
Brunette River	Sapperton Rod & Gun Club	12	4	incubation, stream improvement, fishways, construction	coho	17,500	76	210
McKinney Creek	Eric Langton School (Grade 6)	20	2	information				
Neilson Park/ Draper Creek	Dewdney-Alouette Regional District	6	2	incubation, information, construction	coho	Built rearing channel.		
Kanaka Creek	Greater Vancouver Regional District	20	1	incubation, information	coho	Rearing 15,000.		
					chum	8,000	—	—
					steelhead	Rearing 7,000.		
Silvermere Lake/ Stave River	Silverdale Elementary School	30	2	incubation, construction	chum	24,000	95	—
Inch Creek	Mission School District	7	2	incubation	chum	1,250	25	10
Silverdale Creek	Sun Valley Trout Farms	2	3	incubation, stream improvement	coho	No eggs taken in 1981.		
					chum	9,000	75	72

Contact: Bryan Allen, SEP Community Advisor.

Location	Name of Group	No. of People Involved in 1982	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1982 Releases
Bessette Creek	Lumby and District Wildlife Association	30	3	incubation, construction	coho	Eggs from 1981 brood suffocated due to intake plugging.		
Canoe Creek	Salmon Arm Fish & Game Club	—	2	incubation, stream improvement	sockeye	—	—	—
Tappen Creek	Salmon Arm Secondary School	—	5	incubation in school	coho	—	—	—
Shuswap River/ Mabel Lake	Kingfisher Community Club	25	2	incubation, construction	chinook coho	4,275 2,500	50 50	85 38
Owlhead Creek	Sicamous Rod & Gun Club	15	1	incubation, construction	—	—	—	—
Christian Creek/ Louis Creek	Fins Fish in Natural Setting	14	1	incubation, construction	—	—	—	—
Louis Creek	Louis Creek Enhancement Committee	—	1	incubation	coho	—	—	—
Noble Creek	Arthur Stevenson Elementary School	—	4	incubation	coho	4,800	80	58
Barriere River/ Fennell Creek	David Smith	3	1	incubation	coho	—	—	—
Cook Creek/ Blue River	Blue River Lioness Club	—	4	incubation	coho	2,800	80	34
Tranquille Creek	North Kamloops Elementary School	10	3	incubation in school	coho	1,500	25	18
Nicola River	Lower Nicola Indian Band	4	2	—	—	—	—	—
Nicola River	Merritt Rod & Gun Club	6	2	incubation	chinook	2,500	45	56
Yalakom River	Lillooet Secondary School	50	4	incubation	coho	30,000	86	450
Yalakom River	Lillooet Rod & Gun Club	50	2	stream improvement	—	—	—	—
Chilako River/ Hutda Lake	Hutda Lake Corrections Camp	85	2	incubation, construction	chinook	Eggs of 1981 brood died of excessive temperatures.		
Nechako River	Phoenix Transition Society	15	1	incubation, construction	—	—	—	—
Salmon River	Spruce City Wildlife Association	100	5	incubation, construction	chinook sockeye	— —	— —	— —

Contact: Dennis Demontier, SEP Community Advisor

Table 9

Fraser River SEP Facilities*: Juvenile Releases 1982

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size(g)
Inch Creek Hatchery						
Coho	1981	Siddle Cr.	40,552	86.4	71.3	3.65
Coho	1981	Norrish Cr.	4,695	0	76.3	2.72
Coho	1981	Inch Cr.	10,095	0	66.6	3.25
Coho	1981	Nicomen Sl.	41,465	82.6	60.7	3.40
Coho	1981	Squakum Cr.	1,000	0	89.4	2.36
Chum	1981	Blaney Cr.	1,823,404	4.5	87.8	1.40
Chum	1981	Inch Cr.	1,284,194	0	95.2	1.00
Cutthroat	1981	Silverdale Cr.	9,023[1]	100	55.0	50-104
Cutthroat	1981	Silverdale Cr.	3,000[2]	100		55.00
Cutthroat	1981	Silverdale Cr.	10,191[3]	100		72-75
Cutthroat	1981	Silverdale Cr.	2,000[4]	100		96.00
Fraser Valley Trout Hatchery						
Steelhead	1981	Alouette R.	20,666	100	N/A	63.30
Steelhead	1981	Coquihalla R.	38,460	100	N/A	57-96
Steelhead	1981	L. Campbell R./ Murray Cr.	14,852[5]	100	N/A	80.60
Steelhead	1981	Marshall Cr.	2,719	100	39.0	66.20
Steelhead	1982	Alouette R.	3,142	0	N/A	5-10
Steelhead	1982	Coquihalla R.	41,118	0	N/A	1.20
Steelhead	1982	Coquihalla R.	6,300[6]	100	N/A	15.00
Steelhead	1982	Coquihalla R.	109,185[7]	0	85.0	3.00
Steelhead	1982	L. Campbell R.	5,557	0	N/A	1.60
Steelhead	1982	Marshall Cr.	8,790	0	N/A	0.42
Steelhead	1982	Silverhope Cr.	56,100	0	62.0	3.00
Steelhead	1982	Squamish R.	69,330[8]	0	83.0	1.60
Steelhead	1982	Squamish R.	12,247[9]	0		2.70
Steelhead	1982	Suskwa R.	48,300	100	65.0	2.00
Cutthroat	1982	Silverdale Cr./ Whonnock Cr.	21,000[10]	0	N/A	1.50
Cutthroat	1982	Serpentine R./ Murray Cr.	12,300[11]	0	N/A	1.20
Cutthroat	1982	Colquitz R.	5,000	100	N/A	2.00
Cutthroat	1982	Sandhill	12,036	100	30.4	3.00
Cutthroat	1982	Oyster R.	4,860	100	71.5	1.70
Surrey Rearing Ponds						
Steelhead	1981	L. Campbell R.	4,029	100	N/A	112.00
Cutthroat	1981	Serpentine R./ Murray Cr.	21,167[12]	100	55.0	87-112
Cutthroat	1981	Serpentine R./ Murray Cr.	500[13]	100	N/A	35.40
Alouette River Hatchery						
Steelhead	1981	Alouette R.	3,732	100	N/A	56.50
Steelhead	1981	Alouette R.	1,832	100	N/A	12.20

Table 9 (Cont'd)

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size(g)
Chilliwack River Hatchery						
Coho	1980	Dolly Varden Cr.	45,380	99.8	63.1	25.20
Coho	1980	Post Cr.	37,306	94.6	80.9	25.20
Coho	1980	Salwein Cr.	62,888	96.8	63.9	25.20
Chinook	1981	Pitt R.	100,644	100	71.9	4.50
Chinook	1981	Harrison R.	356,388	21.1	60.9	5.36
Chinook	1981	Chilliwack R.	4,666	100	49.1	3.20
Chum	1981	Chilliwack R.	3,933,852	5.2	83.1	0.90
Steelhead	1981	Chilliwack R.	66,389	100	N/A	107.10
Chehalis Band Project						
Chinook	1981	Harrison R.	79,260	N/A	N/A	N/A
Chum	1981	Harrison/ Chehalis	2,277,121	N/A	N/A	N/A
Jones Creek Spawning Channel						
Pink	1981	Jones Creek	1,572,000	0	71.0	N/A
Chum	1981	Jones Creek	251,000	0	90.0	N/A
Birkenhead River Hatchery						
Chinook	1981	Birkenhead R.	36,500	100	N/A	4-5
Loon Creek Hatchery						
Chinook	1981	Nicola R.	39,400	83	51.0	1.2-3.3
Chinook	1981	Bonaparte R.	52,500	88	73.0	1.0-2.7
Steelhead	1981	Bonaparte/ Deadman R.	38,586	68	32.8	11.4-55.5
Steelhead	1982	Nicola R.	38,000	0	32.7	0.20
Quesnel River Hatchery						
Chinook	1981	Quesnel R.	62,300	92	63.4	5.20
Penny Pilot Hatchery						
Chinook	1981	Bowron R.	84,435	78	83.5	1.30
Chinook	1981	Slim Cr.	67,058	79	74.7	1.60

*Includes facilities constructed prior to SEP.
N/A means "not available."
[1] Released into Stave River.
[2] Released into Brunette River.
[3] Released into Nicomen Slough.
[4] Released into Marshall Creek.
[5] Released into Nicomekl River.
[6] Released above Ladner Creek.
[7] Released into upper Silverhope Creek.
[8] Released into Ashlu River.
[9] Released into Shovelnose Creek.
[10] Released into Scott, Hoy, deBouville, and Silverdale Creeks.
[11] Released into Bear and Murray Creeks.
[12] Released into Serpentine and Nicomekl Rivers.
[13] Released into Little Campbell River.

Table 10

Fraser River SEP Facilities*: Status at December 1982

Species	Stock	Brood	Stage	No. on Hand	Expected Release		
					Date	Number	Site
Inch Creek Hatchery							
Coho	Inch Cr.	82	egg	104,828	May 1984	70,000	Inch Cr.
Coho	Nicomen Sl.	82	egg	183,082	October 1983	75,000	Pye, Barnes,
					May 1984	64,000	Deroche Cr.
Coho	Siddle Cr.	82	egg	23,000	July 1983	21,163	Siddle Cr.
Coho	Norrish Cr.	82	egg	41,553	May 1984	32,000	Norrish Cr.
Chum	Inch Cr.	82	egg	2,711,655	April-May 1983	2,581,496	Inch Cr.
Chum	Blaney Cr.	82	egg	604,907	March 1983	532,318	Blaney Cr.
Chum	Stave R.	82	egg	3,571,393	March-May 1983	2,142,836	Stave R.
Fraser Valley Trout Hatchery							
Steelhead	Coquihalla R.	82	presmolt	33,276	May 1983	33,200	Coquihalla R.
Steelhead	Alouette R.	82	presmolt	15,774	May 1983	15,700	Alouette R.
Steelhead	L. Campbell/ Murray Cr.	82	presmolt	15,476	May 1983	15,400	Nicomekl R.
Steelhead	Marshall Cr.	82	presmolt	5,680	May 1983	5,600	Marshall Cr.
Cutthroat	Fraser R.	82	presmolt	33,720	April-May 1983	33,000	Nicomen Sl., Stave R., Brunette R., Marshall Cr.
Surrey Rearing Ponds							
Steelhead	L. Campbell R.	82	presmolt	7,350	May 1983	7,300	L. Campbell R.
Cutthroat	Murray Cr.	82	presmolt	24,090	April 1983	24,000	Serpentine/ Nikomekl R.
Alouette River Hatchery							
Coho	Brunette R.	81	smolt	20,000	April 1983	20,000	Brunette R.
Coho	Alouette R.	82	egg	48,000	Sept. 1983	46,000	Alouette R.
Chum	Alouette R.	82	alevin	101,000	May 1983	100,000	Alouette R.
Steelhead	Alouette R.	81	smolt	6,000	May 1983	6,000	Alouette R.

Table 10 (Cont'd)

Species	Stock	Brood	Stage	No. on Hand	Expected Release Date	Expected Release Number	Expected Release Site
Chilliwack River Hatchery							
Coho	Dolly Varden Cr.	81	fingerling	140,917	May 1983	140,000	Dolly Varden Cr.
Coho	Post Cr.	81	fingerling	97,748	May 1983	96,000	Post Cr.
Coho	Salwein Cr.	81	fingerling	20,991	May 1983	20,000	Salwein Cr.
Coho	Chilliwack R.	81	fingerling	32,345	April-June 1983	30,000	Chilliwack R.
Coho	Dolly Varden Cr.	82	egg	203,880	May 1984	132,000	Chilliwack R.
Coho	Post Cr.	82	egg	65,069	March 1983	64,000	Post Cr.
Coho	Salwein Cr.	82	egg	127,184	May 1984	110,000	Salwein Cr.
Coho	Chilliwack R.	82	egg	400,000	April-June 1984	300,000	Chilliwack R.
Chinook	Harrison R.	82	egg	1,200,000	June 1983	1,020,000	Chilliwack R.
Chinook	Chilliwack R.	82	egg	12,778	June 1983	12,600	Chilliwack R.
Chum	Chilliwack R.	82	egg	5,100,000	April 1983	4,700,000	Chilliwack R.
Steelhead	Chilliwack R.	81 82	fingerling	124,678	May 1983	124,000	Chilliwack R.
Chehalis Band Project							
Chinook	Harrison R.	82	egg	83,859	April 1983	80,000	Harrison R.
Chehalis River Hatchery							
Coho	Weaver Cr.	82	egg	207,400	May 1983	140,000	Weaver Cr.
Coho	Evans Cr.	82	egg	77,200	May 1983	52,000	Evans Cr.
Coho	Chehalis R.	82	egg	20,400	May 1983	13,800	Chehalis R.
Coho	Harrison R.	82	egg	93,600	May 1983	63,000	Harrison R.
Coho	Coho Cr.	82	egg	93,700	May 1983	63,200	Coho Cr.
Coho	Hicks Cr.	82	egg	37,000	May 1983	25,000	Hicks Cr.
Chinook	Harrison R.	82	egg	962,000	May 1983	650,000	Chehalis R.
Chum	Chehalis R.	82	egg	1,192,500	March 1983	900,000	Chehalis R.
Chum	Harrison R.	82	egg	5,801,200	April 1983	4,400,000	Harrison R.
Chum	Squakum Cr.	82	egg	1,461,000	April 1983	1,100,000	Squakum Cr.
Chum	Weaver Cr.	82	egg	611,900	April 1983	465,000	Weaver Cr.

Jones Creek Spawning Channel

No pink salmon escapement in even years.

Table 10 (Cont'd)

Species	Stock	Brood	Stage	No. on Hand	Expected Release Date	Expected Release Number	Site
Birkenhead River Hatchery							
Chinook	Birkenhead R.	82	egg	162,000	April-May 1983	140,000	Birkenhead R.
Loon Creek Hatchery							
Chinook	Bonaparte R.	82	alevin	38,155	May 1983	37,500	Bonaparte R.
Steelhead	Deadman R.	82	presmolt	55,580	May 1983	55,000	Bonaparte R.
Quesnel River Hatchery							
Chinook	Quesnel R.	82	alevin	578,863	March-May 1983	530,000	Quesnel R.
Chinook	Blackwater R.	82	fry	42,328	April 1983	40,000	Blackwater R.
Chinook	Bowron R.	82	fry	374,194	April 1983	350,000	Bowron R.
Chinook	Slim Cr.	82	fry	554,185	April 1983	500,000	Slim Cr.
Penny Pilot Hatchery							
Chinook	James Cr.	82	alevin	198,363	May-July 1983	180,000	James Cr.
Stuart River Pilot Hatchery							
Chinook	Stuart R.	82	fry	57,000	April 1983	53,000	Stuart R./ Dog Cr.

*Includes facilities constructed prior to SEP.

Table 11

Fraser River SEP Facilities: Surplus Sales 1982*

Species	Amount of Fish (kg)	Eggs (number)	Native Food Fish (pieces)	Value ($)
Inch Creek Hatchery				
Chum	10,000	0	0	400.00
Chehalis River Hatchery				
Chinook	0	28,000	0	--[1]
Birkenhead River Hatchery				
Chinook	0	1,000	0	--[1]

*Includes facilities constructed prior to SEP.
[1] No payment received; provided for research purposes.

Table 12

Fraser River SEP Facilities: Escapement to Facility 1982*

Species	Escapement to Facility	Spawned for Hatchery Stock male	 female	% Marked male and female
Inch Creek Hatchery				
Chum	8,500	472	812	8.58
Chilliwack River Hatchery				
Coho (jacks)	900	0	0	100

*Includes facilities constructed prior to SEP.

Table 13

Fraser River SEP Facilities: Adult Production*

	Expected Production from 1982 Releases			At Full Production	
Species	Total Adult Production	Years of Return	Contribution to Fisheries	Total Adult Production	Contribution to Fisheries
Inch Creek Hatchery					
Coho	1,445	1983-1985	845	4,100	2,398
Chum	61,950	1984-1986	26,923	70,400	30,596
Cutthroat	1,936	1984-1985	1,297	3,000	2,010
Fraser Valley Trout Hatchery					
Steelhead	7,639	1984-1985	3,820	5,650	3,390
Cutthroat	5,520	1984-1985	3,698	5,500	3,685
Surrey Rearing Ponds					
Steelhead	161	1984-1985	82	400	240
Cutthroat	1,698	1984-1985	560	2,000	1,340
Alouette River Hatchery					
Coho	--	--	--	1,100	632
Chinook	--	--	--	1,100	884
Chum	1,277	1984-1986	554	21,600	9,387
Chilliwack River Hatchery					
Coho	21,836	1983-1985	12,774	150,000	87,750
Chinook	13,851	1983-1986	11,341	32,400	26,529
Chum	77,699	1984-1986	33,767	100,000	43,460
Steelhead	2,655	1984-1985	1,593	6,000	3,600

Table 13 (Cont'd)

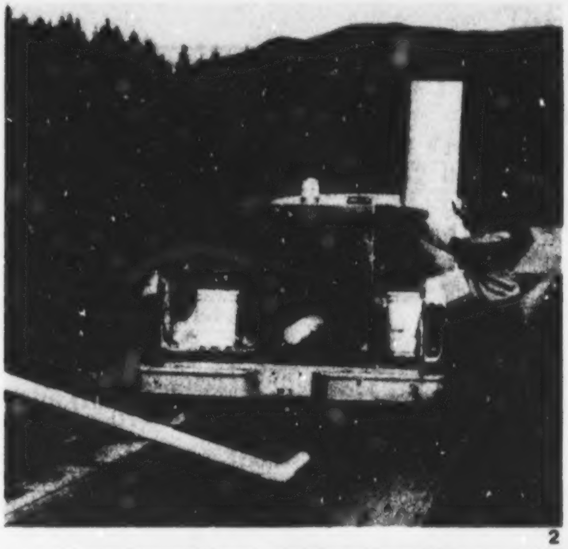
	Expected Production from 1982 Releases			At Full Production	
Species	Total Adult Production	Years of Return	Contribution to Fisheries	Total Adult Production	Contribution to Fisheries
Chehalis Band Project					
Coho	--	--	--	7,000	4,081
Chinook	1,909	1983-1986	1,563	2,200	1,768
Chum	18,217	1984-1986	7,917	102,900	44,720
Chehalis River Hatchery					
Coho	--	--	--	64,000	37,440
Chinook	--	--	--	30,000	24,564
Chum	--	--	--	201,600	87,615
Steelhead	--	--	--	4,800	2,880
Cutthroat	--	--	--	5,000	3,350
Jones Creek Spawning Channel					
Chum	2,514	1984-1986	1,092	1,200	522
Pink	39,310	1983	18,908	34,000	16,355
Birkenhead River Hatchery					
Chinook	1,199	1983-1986	982	2,900	2,387
Eagle River Hatchery					
Coho	--	--	--	10,800	6,318
Chinook	--	--	--	8,100	6,632
Loon Creek Hatchery					
Chinook	681	1983-1986	606	1,500	1,125
Steelhead	1,200	1984-1985	600	1,200	720
Quesnel River Hatchery					
Chinook	1,409	1983-1986	1,153	52,600	43,068
Penny Pilot Hatchery					
Chinook	1,136	1983-1986	930	2,900	2,358

*Includes facilities constructed prior to SEP.

West Coast Vancouver Island

1. *By January 1982, Nitinat River hatchery was at full capacity, with chum eggs incubating in modified Atkins cells.*
2. *The San Juan Enhancement Society releases chinook, coho, sockeye and chum fry in the San Juan watershed.*
3. *At Robertson Creek hatchery, a hydraulic powered fish crowder was built for easier handling of adult fish.*
4. *Beach seining in the creek was one method used to obtain coho brood stock for the Thornton Creek project.*

1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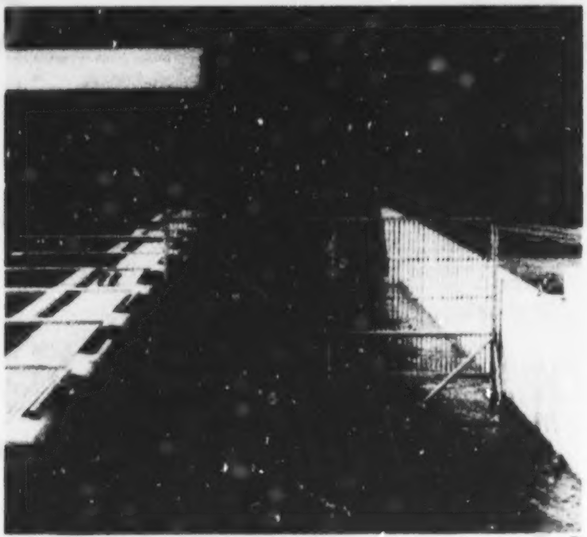
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West Coast Vancouver Island

San Juan Enhancement Society Project

This project is located on Four Mile Creek, a tributary of the San Juan River near Port Renfrew. The purpose of this project is to enhance wild stocks in the San Juan watershed; namely, chinook, coho, sockeye and chum salmon.

Employment is provided for one full-time employee, and one person part-time. Community involvement in this project is excellent, with a volunteer group assisting in the labor-intensive job of capturing brood stocks.

In 1982, the hatchery on Four Mile Creek incubated and reared chinook, coho, sockeye and chum salmon. Chinook were reared to a weight of five grams and then released, and coho were released as fry. Sockeye were released as fry after emergence from the incubation boxes.

An incubation building was constructed in 1982 to accommodate extra Heath trays and Atkins boxes. A 760-metre pipeline was constructed to supply extra water to the hatchery. Two buildings were constructed for the storage of supplies and fuel at the hatchery site.

Many hours of volunteer work were provided in 1982, resulting in the record capture of coho brood stock, with approximately 2.3 million eggs taken.

The first returns of tagged chinook, incubated at the San Juan project since 1979, are not expected until fall 1983.

Contact: Barry Cordocedo, Project
Coordinator, Special Projects
Division.

Nitinat River Hatchery

Nitinat River hatchery is located at the confluence of the Nitinat and Little Nitinat Rivers, approximately 60 km southwest of Port Alberni.

This Japanese-style hatchery was designed to incubate 28 million chum eggs and 1.5 million chinook eggs incubated in Heath trays.

In spring 1982, 27.5 million chum and 491,000 chinook eggs were incubated at Nitinat. Owing to generator failures during this period, a premature release of seven million chum fry was necessary. These fry weighed 0.77 grams rather than the recommended 1.0 gram. Fortunately, a proportion of these fry had already been marked by fin clipping, so that the relative success of this untimely release can be evaluated. The remaining 21 million chum fry were divided into three experimental groups. One percent of each group was marked, and the three groups were released at ten-day intervals. By completing this study, SEP hopes to be able to predict an optimum release date for chum smolts into the Nitinat River system.

During the summer, the gravel in the 24 keeper ponds was cleaned and preparations were made for the coming fall program.

In 1982, upgrading work was carried out at the facility to meet operational requirements. Metal work was installed in the rearing channels and aeration tower to facilitate easier access. To improve the operation of the fishway, several low-cost weirs utilizing precast highway dividers were installed.

Owing to a poor escapement of chum to Nitinat hatchery in the fall of

1982, production capacity was not met, and only 9.1 million chum eggs were taken. Chinook returns were normal, enabling the production goal of 1.5 million eggs to be surpassed by one million. Of these, 40,000 were transplanted to the Sooke River volunteer project. In addition, 79,000 coho eggs were also taken.

Although no adult chum or chinook salmon returned to the hatchery from the 1980 pilot release, the recovery of four marked chinook jacks and one marked chum jack provided the first indication of this hatchery's success. It is expected that the first hatchery stocks will return to the facility in the fall, 1983.

Besides upgrading work, a two-storey manager's residence, an eight-vehicle carport and a boat ramp were built in 1982.

Depending on the 1983 budget, investigations may be carried further to explore an alternate power supply using hydro-generated power rather than generators. In addition, work may be considered for the release channel and a brailer system, both of which will greatly enhance the fish handling capability at Nitinat River hatchery.

Contact: Karl Petersen, Stock Enhancement Officer, Enhancement Operations; James Yong, Project Engineer, Engineering.

Robertson Creek Hatchery

Robertson Creek hatchery is both a production and a research-oriented facility located near the outlet of Great Central Lake, approximately 15 km northwest of Port Alberni. The facility started out in 1959 as a spawning channel for pink salmon. It was officially opened in 1960 and was reported to be the largest artificial spawning channel in North America. The main purpose of the Robertson Creek project was to introduce pink salmon to the Somass River system. It was also anticipated to build up runs of chinook and coho salmon. Robertson Creek spawning channel failed to meet its objectives in 1959, despite a 95 percent egg-to-fry survival rate.

In 1972, a pilot hatchery program was set up and subsequently expanded to full hatchery operation with a Heath tray capacity for six million chinook and 500,000 coho. The major objective was to enhance chinook and steelhead stocks at Robertson Creek. The facility proved very successful with releases in 1974 of one to 1.5 million chinook, 100,000 coho and 10,000 steelhead trout.

This success of Robertson Creek led to its expansion in 1975, with the construction of two combination holding/rearing ponds. By 1978, annual smolt releases approached eight million chinook, 500,000 coho and 10,000 steelhead. A terminal net fishery was initiated in 1978 in the Alberni Inlet to catch excess chinook returning to the hatchery.

To handle large adult escapements of chinook to the facility and to accommodate an increase in annual smolt production, as well as to mitigate higher exploitation rates on steelhead as a result of increased commercial fishing pressure, Robertson Creek was once again expanded in 1981.

In 1982, the fishway was modified to provide better fish passage during exceptionally low water levels in Stamp Lagoon. This was accomplished by constructing an adjustable stop-log enclosure around the diffuser to build up the water level in the bottom bay. A water bypass was also installed in the fishway approach channel to reduce the volume of water in the fishway. The fish handling system was modified to include a hydraulic-powered fish crowder. In addition, an emergency water supply for incubation and rearing was installed. This system consists of pumping water from Stamp Lagoon, using a submersible pump and small diameter pipeline, into the existing gravity-fed lines that already supply the incubation facility and rearing troughs. Total production capacity for Robertson Creek now stands at nine million chinook smolts, 1.5 million coho smolts, and 250,000 steelhead smolts, with an estimated adult production of 270,000 chinook, 150,000 coho and 7,500 steelhead each year.

Robertson Creek hatchery has also been used as a research facility. In 1981, chinook eggs were collected from the Nahmint River, located approximately 25 km south of Port Alberni on the west side of Alberni inlet. This egg-take resulted in the release of 16,675 smolts into Kanyon Creek which is a tributary of the Nahmint River. In the fall of 1982, the Nahmint River was again the site of a chinook egg-take; currently there are 124,000 Nahmint chinook incubating at Robertson Creek. It is expected that with work continuing on the Nahmint River, chinook stocks can be restored to historic levels of abundance and lead eventually to the opening of the Nahmint estuary to both sport and commercial fishing.

Over the years, Robertson Creek chinook have contributed greatly to the various fisheries. An estimated 150,000 fish go to the sport fishery, 15,000 to the native food fishery, 42,000 to the terminal net fishery, and an estimated 100,000 fish contribute to the central coast and northern commercial fisheries. The estimated catch for 1982 was 172,000.

Contact: Don Lawseth, Stock Enhancement Officer, Enhancement Operations; Otto Rapp, Senior Project Engineer, Engineering.

Thornton Creek Hatchery

This project is located at the mouth of Thornton Creek near Ucluelet. It is operated by the Thornton Creek Enhancement Society, under contract to SEP.

The Society enhances coho and chinook stocks in the Kennedy River system with the ultimate goal of establishing a sport fishery in the Ucluelet area.

This project provides employment for two people full-time and one person part-time. A volunteer project works alongside the Thornton Creek Society, rearing coho at the hatchery.

In 1982, approval was obtained by the Society to transplant 50,000 chinook and 50,000 coho eggs from Robertson Creek hatchery. Capilano troughs were purchased to provide additional rearing capacity at the hatchery. Local students were hired under the job creation program in 1982 to carry out stream reconnaissance work in the Ucluelet area.

Contact: Barry Cordocedo, Project Coordinator, Special Projects Division.

Tlupana Inlet/Conuma Hatchery

Conuma hatchery is located on the Conuma River, 42 km west of Gold River. This project uses the Conuma River site as a parent hatchery and brings in brood stock from five streams around Tlupana Inlet. Chum fry reared to a weight of one gram, are released to their parent streams by both truck and helicopter.

The Japanese-style hatchery came close to target production in 1982, with egg-takes of 21 million chum, 500,000 chinook and 180,000 coho.

In 1982, three-year-old chinook returned to the Conuma River hatchery. As in the previous year, these fish tended to remain with the wild stock in the main river. No serious attempts were made by these fish to ascend the fishway into the hatchery holding ponds.

Tagged three- and four-year-old chum also returned among the wild Tlupana stocks. Preliminary indications are that the chum fry that were returned to their parent streams for imprinting, are returning to these streams as adults. The data are not conclusive, however, because of relatively small releases in 1979 and 1980.

It is expected adult returns will show a significant increase during the fall of 1983, as returns from larger releases are expected.

In 1982, a new residence was constructed at the Conuma River site to accommodate the assistant hatchery manager year-round.

Special activities undertaken at the Conuma River hatchery included:

a) Coho Colonization

In the spring of 1982, approximately 55,000 coho fry were transported by helicopter to the upper Conuma River. They were released over a 6 km reach of the river that is not accessible to the adults because of a series of falls. The fry were fin clipped and will be sampled during the 1983 spring migration. The survival and growth rates of the transplanted coho were evaluated during the summer months.

b) Keeper Channel Studies

The Deserted Lake stock of chums was divided and placed in two sets of three keeper channels each. Three channels with coarse gravel and three with finer gravel were loaded with different densities of eggs. Results of this experiment will be assessed with adult returns.

c) Research Experiments

Work on mortality problems associated with the Deserted Lake stock was again planned at Conuma River hatchery during the 1982 egg-take. Unfortunately, a severe storm destroyed the adult holding pens and resulted in an early finish to the experiment. However, enough data were collected this year and in previous years to convince hatchery staff to terminate the holding of adult chums in salt water. Some 5.3 million eggs taken from adults held in fresh water and with fertilization delayed resulted in only five percent mortality.

Dr. Tom Quinn again used the Conuma River site to study the effects of magnetic tags on the migration patterns of chum fry.

d) Different Spawning Techniques

In 1982, one million eggs were taken from each of Conuma River and Tlupana River stocks with the aid of a small seiner. These eggs were taken from fish caught by the seine in salt water. The fish were held briefly and then killed and spawned. In each case, the early egg mortality was about 10 percent. Since water temperatures were 15-19°C, these mortalities are considered acceptable.

e) Experimental Upwelling Incubators

Four Capilano troughs were fitted with upwelling incubators loaded with intalox saddles (small, saddle-shaped pieces of plastic used in place of gravel). Each box was loaded with 50,000 eyed chum eggs on screens. This system is being tested as an alternate method to the use of keeper channels in the rearing of smaller stocks, i.e. less than two million eggs. Results of this experiment will be reported in an information memo and possibly a technical report.

Contact: Iain MacLean, Stock Enhancement Officer, Enhancement Operations; Otto Rapp, Senior Project Engineer, Engineering.

Job Creation Projects

Four Mile Creek Project

A job creation project was sponsored by the San Juan Enhancement Society to assist the existing Community Economic Development Program hatchery at Four Mile Creek in Port Renfrew.

Four people were employed in the construction of two storage sheds at the hatchery site. Other activities included operating an emergency pumping system during a fall flood; digging a test well and access road; insulating the egg-take building and removing fallen trees obstructing the hatchery pipeline. The crew assisted in locating and capturing 450 adult coho salmon at Granite Creek and the subsequent egg-take yielding 800,000 eggs. The crew also helped remove dead eggs at the Four Mile Creek hatchery.

Mosquito Creek Logjam Removal

Mosquito Creek flows into the Lower San Juan River in Port Renfrew. A large obstruction developed at the confluence of these streams and prevented the migration of salmon. Seven people from the Sooke and Port Renfrew areas removed the debris to provide unobstructed passage for salmon.

Sooke Stream Enhancement Project

The Sooke Conservation Society sponsored a job creation project in the Sooke area to carry out a wide range of fisheries activities. Eight people removed obstructions to salmon migration in Tugwell and DeMamiel Creeks and cleaned debris from Lannon Creek. Other activities included improvements to the road access on DeMamiel Creek and trail improvements to various streams.

The crew assisted in brood stock capture and egg-takes on DeMamiel Creek and Rocky Creek. At the Sooke hatchery on Rocky Creek, an incubation shed was constructed and a hatchery waterline was excavated.

Contact: Tony Stein, Project
Developer, Job Creation Unit,
Special Projects Division.

Nitinat Hatchery Augmentation

The objective of this project is to provide the Nitinat hatchery with auxiliary workers to allow the hatchery crew to undertake coho outplanting in Nitinat River tributaries. The Nitinat Band Council provided two people to assist hatchery staff in examining utilization and availability of spawning and rearing habitat in the Nitinat River area. This project is continuing directly through a NEED project, coordinated with the planned coho release sites.

Alberni Valley Chamber of Commerce Project

The Alberni Valley Chamber of Commerce project has created nearly 500 weeks of work by supplying workers to the Robertson Creek hatchery, to augment regular hatchery activities. A major project involved renovating the old crew residence at the hatchery into modern offices. Also, a new wooden fishway was built in the Kitnutsis River; previously, the fishery officers had to shore up the old one annually. This has been a very successful project and many other activities are planned.

Nuu-chah-nulth Tribal Council Project

The west coast Indian bands have requested the Nuu-chah-nulth Tribal Council provide overall project coordination and technical supervision. Accordingly, the Council hired a project coordinator and three supervisors to administer the work.

Sheshaht and Opetchesaht Bands Project

The crew conducted spawning counts in a number of creeks in the northern and eastern ends of Alberni Canal. Stream assessment and monitoring was also conducted, so that more detailed surveys were undertaken in places which were not visited by a fishery officer. Also, the crew constructed and set up an incubation box at Draw Creek, which was monitored by the Ucluelet/Toqualt project.

The crew also completed the construction of a roadside tourist stop, adjacent to the Sumas River bridge on the Sheshaht reserve. The attractive signs contain information about salmonid biology and fisheries.

Thornton Creek Hatchery Augmentation

The Thornton Creek Enhancement Society in Ucluelet operates a small hatchery under the Community Economic Development Program. In 1982, the Society employed local commercial fishermen to assist in hatchery operations.

Utilizing information from earlier reconnaissance studies, the job creation crew collected coho brood stock for the hatchery. The crew also built and installed incubation boxes on local streams, cut access trails and monitored water flows and temperature.

Ucluelet and Toquaht Bands Projects

The crew conducted spawning counts, stream assessment and monitoring in a number of creeks in the northwest area of Barkley Sound, similar to the Clayoquot Band Council projects in Clayoquot Sound. Similarly, estuary assessment and monitoring was also undertaken. The crew was also involved in the setup and monitoring of an incubation box at Draw Creek and assisted the Thornton Creek Enhancement Society in obtaining brood stock for their hatchery. A report is in preparation.

Kootowis and Staghorn Stream Clearance Project

Par Cedar Industries Ltd. of Tofino sponsored a stream clearance project in the Kennedy Flats area east of Tofino. A start was made to clear large logjams in Kootowis and Staghorn Creeks. Although inroads have been made, much more work is required to complete this stream clearance project.

Clayoquot Sound Project

The Friends of Clayoquot Sound Society, an environmental group based in Tofino, sponsored a job creation project that hired three people to count spawners in streams of Clayoquot Sound near Tofino. With guidance from the local fishery officer and support from the Parks Branch, the crew successfully completed an escapement survey for this remote region on the west coast of Vancouver Island.

Clayoquot Band Project

The crew conducted spawning counts in a number of creeks on Meares Island as well as other areas of southern Clayoquot Sound. Stream assessment was also undertaken primarily to learn more about the salmon production potential. This was coupled with water discharge, temperature and quality monitoring in selected locations. A similar program was conducted to assess and monitor estuaries for their potential for enhancement and/or mariculture. A report is in preparation.

Kwakiutl Band Council Project

The crew undertook stream cleanup and gravel deposition in Mullen Creek and also conducted a coho egg take. Eggs were put in a renovated hatchery tray unit in the village, but died as a result of water quality problems. Additional eggs were put in a makeshift Vibert box and planted in Mullen Creek. The crew was loaned to the Fish and Wildlife Branch to help staff the O'Connor Lake project; they were involved in monitoring fry traps, temperatures and discharge in Mullen Creek.

Salmon River Obstruction Assessment

Two projects proceeded under the sponsorship of David Muir:

- rebuilt an old timber crib dam on east Thurlow Island; this has ensured fish access to the watersheds on the island and allowed the installation of a hatchery pipe as well, for future considerations. This was done with a concrete dam, with rock fill--a very good job in a remote location.
- an assessment of obstruction in the Salmon River watershed was undertaken. Crews inspected all of the tributaries and produced a map, indicating these obstructions in considerable detail. Future plans are to continue with spawner and downstream assessment programs, if funding permits.

Contact: Judy Barnetson, Project
Developer, Job Creation Unit,
Special Projects Division.

Table 14

Public Participation Projects

WEST COAST VANCOUVER ISLAND PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1982	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1982 Releases
Saltery Bay Creek	Universal Studies Group	3	2	studies, information, research	chum	—	—	—

Contact: Bob Hurst, SEP Community Advisor.

Location	Name of Group	No. of People Involved in 1982	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1982 Releases
Memekay River	Pacific Trollers Assn.	18	6	incubation, construction	coho chinook	4,500 80,000	90 80	54 2,400
Nequiltpaalis Cr.	Western Forest Products	10	2	incubation	chum	39,000	87	312
Aweisha Creek	Quatsino School	25	2	incubation in school and creek	chum	3,500	70	—
Marble River	Western Forest Products	150	2	incubation	chinook coho	3,400 498	97 99	67 6
Goodspeed River	Holberg Community	10	5	incubation	coho	4,500	90	54

Contact: George Bates, SEP Community Advisor.

Table 15

West Coast Vancouver Island SEP Facilities*:
Juvenile Releases 1982

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size(g)
San Juan Enhancement Society Project						
Coho	1981	San Juan	512,415	0	85	0.7-1.0
Chinook	1981	San Juan	186,932	51	76	2.75
Chum	1981	San Juan	7,820	0	98	0.4
Sockeye	1981	San Juan	92,874	0	98	0.3
Nitinat River Hatchery						
Chinook	1981	Nitinat	491,000	17.81	89	5.34
Chum	1981	Nitinat	27,178,000	1.09	92	0.59
Robertson Creek Hatchery						
Coho	1980	Robertson Cr.	991,262	14.6	65.18	23.4
Chinook	1981	Nahmint R.	16,675	93.28	77.6	5.0
Chinook	1981	Robertson Cr.	7,787,979	0.96	73.13	4.84
Chinook	1981	diet study	54,335	93.6		4.53
Steelhead	1981	Robertson Cr.	197,848	49.5	66.5	56.04
Steelhead	1981	Somass R.	23,961	98	47.3	52.2
Thornton Creek Hatchery						
Chum	1981	Thornton	1,276,870	6	90	1.2
Tlupana Inlet/Conuma Hatchery						
Coho	1981	Conuma R.	51,300	100	92	1.1
Coho	1981	Conuma R.	48,000	0	90	15
Chinook	1981	Conuma R.	152,000	50	85	2.5
Chum	1981	Conuma R.	4,080,000	0	94	1.2
Chum	1981	Tlupana R.	375,000	27	71	1.7
Chum	1981	Canton Cr.	417,000	25	74	1.5
Chum	1981	Deserted R.	3,655,000	0	75	1.0
Chum	1981	Sucwoa R.	4,077,000	3.5	87	0.65-1.9

*Includes facilities constructed prior to SEP.

Table 16

West Coast Vancouver Island SEP Facilities: Status at December 1982*

Species	Stock	Brood	Stage	No. on Hand	Expected Release		Site
					Date	Number	
San Juan Enhancement Society Project							
Coho	Harris/ Granite Cr.	82	egg	1,160,515	May 1983	1,044,463	Harris/ Granite Cr.
Chinook	Harris Cr.	82	egg	166,000	June 1983	149,400	Harris Cr.
Chum	Granite Cr.	82	egg	2,500	April 1983	2,250	Granite Cr.
Sockeye	Granite Cr.	82	egg	30,000	April 1983	27,000	Granite Cr.
Nitinat River Hatchery							
Coho	Nitinat R.	82	egg	78,000	June 1983	75,000	Nitinat R.
Chinook	Nitinat R.	82	egg	2,422,000	May 1983	2,150,000	Nitinat R.
Chum	Nitinat R.	82	egg	8,568,000	April 1983	7,797,000	Nitinat R.
Robertson Creek Hatchery							
Coho	Robertson Cr.	81	fry	983,195	April 1983	975,000	Robertson Cr.
Coho	Robertson Cr.	82	egg	1,379,008	April 1984	1,000,000	Robertson Cr.
Chinook	Robertson Cr.	82	egg	9,612,386	June 1983	7,500,000	Robertson Cr.
Chinook	Nahmint R.	82	egg	126,584	May 1983	125,000	Nahmint R.
Steelhead	Robertson Cr.	--	adult	353[1]	--	--	--
Steelhead	Somass R.	--	adult	50[2]	--	--	--
Steelhead	Robertson Cr.	82	fry	122,826	May 1983	122,000	Robertson Cr.
Steelhead	Somass R.	82	fry	18,854	May 1983	18,750	Somass R.
Thornton Creek Hatchery							
Coho	Staghorn Cr.	82	egg	13,337	May 1983	12,000	Staghorn Cr.
Coho	Kootowis Cr.	82	egg	74,961	May 1983	67,400	Kootowis Cr.
Coho	Kennedy R.	82	egg	13,320	May 1983	12,000	Kennedy R.
Coho	Lost Shoe Cr.	82	egg	2,771	May 1983	2,490	Lost Shoe Cr.
Coho	Robertson Cr.	82	egg	30,000	May 1983	27,719	Thornton Cr.
Chinook	Kennedy R.	82	egg	12,811	June 1983	11,530	Kennedy R.
Chinook	Robertson Cr.	82	egg	49,850	June 1983	44,800	Thornton Cr.
Chum	Thornton Cr.	82	egg	685,416	April 1983	616,874	Thornton Cr.
Tlupana Inlet/Conuma Hatchery							
Coho	Conuma R.	82	alevin	180,000	Sept. 1983	165,000	Conuma R.
Chinook	Conuma R.	82	alevin	492,000	May 1983	480,000	Conuma R.
Chum	Conuma R.	82	alevin	5,250,000	April 1983	5,100,000	Conuma R.
Chum	Tlupana R.	82	alevin	2,600,000	April 1983	2,550,000	Tlupana R.
Chum	Canton Cr.	82	alevin	1,418,000	April 1983	1,400,000	Canton Cr.
Chum	Sucwoa R.	82	alevin	4,900,000	April 1983	4,800,000	Sucwoa R.
Chum	Deserted R.	82	alevin	5,000,000	April 1983	4,900,000	Deserted R.

*Includes facilities constructed prior to SEP.

[1] Brood stock which should produce 175,000 juveniles for release in May 1984.

[2] Brood stock which should produce 35,000 juveniles for release in May 1984.

Table 17

West Coast Vancouver Island SEP Facilities: Surplus Sales 1982*

Species	Amount of Fish (kg)	Eggs (number)	Native Food Fish (pieces)	Value ($)
Nitinat River Hatchery				
Chinook	0	45,000	0	--[1]
Robertson Creek Hatchery				
Coho	48,919.22	0	0	88,907.61
Chinook	248,247.08	0	0	229,436.98
Mixed[2]	92,559.54	0	0	3,702.38
Coho	0	663,290	0	6,332.90
Coho	0	422,330	0	--[1]
Chinook	0	50,000	0	--[1]
Thornton Creek Hatchery				
Chum	18,574.94	0	0	5,481.69

*Includes facilities constructed prior to SEP.

[1] No payment received; provided for research purposes.

[2] Coho and chinook sold together.

Table 18

West Coast Vancouver Island SEP Facilities: Escapement to Facility 1982*

Species	Escapement to Facility	Spawned for Hatchery Stock male	Spawned for Hatchery Stock female	% Marked male and female
Robertson Creek Hatchery				
Coho	15,301	1,860	620	9.56
Chinook	44,953	6,441	2,147	0.74
Steelhead	1,901	0	0	96.74
Thornton Creek Hatchery				
Chum	11,602	111	346	0
Tlupana Inlet/Conuma Hatchery				
Coho (to Conuma R.)	N/A	70	70	0
Chinook (to Conuma R.)	600	130	130	0
Chum (to Conuma R.)	35,000	2,300	1,100	0.9
Chum (to Sucwoa R.)	20,000	2,500	1,250	5.6
Chum (to Deserted R.)	25,000	3,000	1,500	2.3
Chum (to Tlupana R.)	10,000	1,300	700	0.2
Chum (to Canton Cr.)	10,000	700	350	1.2

*Includes facilities constructed prior to SEP.

N/A means "not available."

Table 19

West Coast Vancouver Island SEP Facilities*: Adult Production

	Expected Production from 1982 Releases			At Full Production	
Species	**Total Adult Production**	**Years of Return**	**Contribution to Fisheries**	**Total Adult Production**	**Contribution to Fisheries**
San Juan Enhancement Society Project					
Coho	6,089	1983-1984	2,131	43,200	15,120
Chinook	4,486	1983-1986	2,476	10,000	5,544
Chum	57	1984-1986	25	300	141
Sockeye	1,560	1984-1986	951	200	122
Steelhead	--	--	--	1,400	1,215
Nitinat River Hatchery					
Chinook	14,749	1983-1986	7,905	32,400	17,366
Chum	543,572	1984-1986	239,171	403,200	177,408
Robertson Creek Hatchery					
Coho	148,690	1983-1984	63,936	150,000	64,350
Chinook	235,768	1983-1986	126,371	225,000	120,600
Steelhead	10,574	1983-1985	9,516	6,700	6,030
Thornton Creek Hatchery					
Coho	--	--	--	9,000	3,861
Chinook	--	--	--	7,600	4,052
Chum	25,537	1984-1986	11,236	50,000	22,000
Tlupana Inlet/Conuma Hatchery					
Coho	2,211	1983-1984	1,050	1,300	617
Chinook	4,560	1983-1986	2,079	43,200	19,699
Chum	252,120	1984-1986	110,932	331,200	145,728

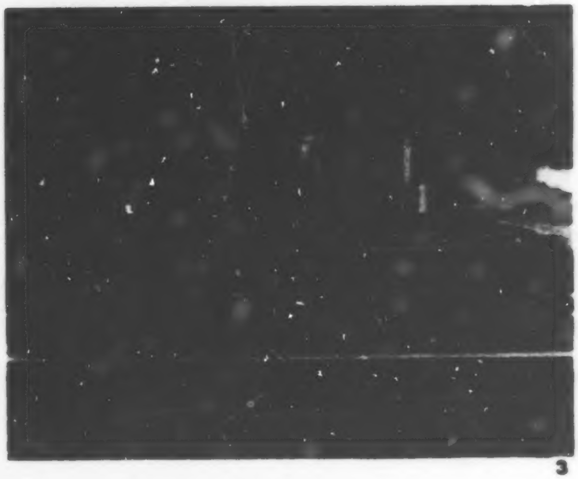
*Includes facilities constructed prior to SEP.

East Coast Vancouver Island

1. *Sorting coho at Puntledge River hatchery.*
2. *The Vancouver Island hatchery for steelhead and cutthroat is located near Duncan.*
3. *The Nanaimo community development project operates a small hatchery and carries out many other activities.*
4. *The Cowichan Band operates a hatchery for chinook, coho and chum salmon.*

1

2



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East Coast Vancouver Island

Cowichan Band Project

This project is located on the lower reaches of the Cowichan River, near Duncan.

The Band enhances stocks in the Cowichan River system; namely, chinook, coho, and chum salmon. Employment is provided for five people full-time and 11 people part-time.

This project has increased public awareness of the salmonid resource by providing hatchery tours.

In 1982, the Band incubated and reared chinook, coho and chum salmon. The chinook were reared for 90 days; the coho were released as fry and the chum were released at a weight of 1.2 grams. Chinook egg-to-fry survival was low because of iron problems in the water supply. Ninety-two Heath trays were installed for the incubation of chinook and coho eggs. Through the 1982 job creation program, stream clearance was done near the hatchery site to improve the natural spawning and rearing habitat for chum salmon.

Contact: Barry Cordocedo, Project Coordinator, Special Projects Division.

Vancouver Island Hatchery

Construction

Since 1978/79, the Fish Culture Section of the Fish and Wildlife Branch has reared and released anadromous cutthroat smolts and some steelhead fry on Vancouver Island. The cutthroat have been reared to smolt size at small net pen facilities, but incubation and early fry rearing for both species has been carried out at the Fraser Valley trout hatchery at Abbotsford.

In order to expand the steelhead fry stocking program to 500,000 fry annually, as well as service the pen-rearing sites on Vancouver Island--and at the same time alleviate concerns about the potential spread of diseases--it was decided to build a fry-rearing facility on Vancouver Island. The facility would produce annually:

- 500,000 steelhead fry for stocking into headwater streams of 4 to 6 different river systems each year
- 80,000 cutthroat fry for small fry stocking projects (20,000±) and further rearing at satellite facilities to produce 45,000 smolts
- 60,000 steelhead fry for further rearing at a satellite facility to produce 50,000 smolts for the Cowichan River.

After reaching an agreement to enter into a five-year lease with the District of North Cowichan, construction of the Vancouver Island hatchery in Duncan was started in February 1982. Site surveys, landfill, and security fencing were quickly completed and the well was put in. The major components of the hatchery were in place in June. Although construction was not yet completed, the water was turned on so the facility could receive fish if necessary. By December 31, the hatchery was virtually completed, and was holding a number of steelhead and cutthroat adults that had been captured from various wild stocks.

Because of the nature of the project - i.e. some uncertainties about the efficacy of fry stocking, and because of the terms of the lease agreement--a facility which could be easily dismantled had to be designed and constructed. The hatchery consists of a well and pumphouse, an electrical house, aeration tower, spawning shed, adult holding facilities for accommodating some 350 adults of eight to 10 different stocks, a portable fabric-covered building 9 m wide by 36 m long, an effluent settling pond, and associated plumbing. In addition, two 12 m construction camp trailers were placed on the site to provide office, workshop, storage, and lunchroom facilities.

At the Vancouver Island hatchery, a new style of fry-rearing trough was developed and fabricated. The trough is rectangular, approximately 6 m long by 1 m wide by 0.6 m high, with a flat bottom. It features a 0.3 m high solid center dividing wall running the length of the trough. When the divider is in place, it effectively provides two troughs 6 m by 0.5 m with 20 to 25 cm of water depth. This flexibility allows for the incubation of eggs in baskets in the small troughs, the isolation of small groups of fish of varying ages within one stock, as well as making it easier to start off the small cutthroat and summer steelhead fry. Removal of the center divider and subsequently raising the water level to 0.5 m will then, of course, provide ample rearing space for growth of any one group or stock of fry.

Operations

Vancouver Island hatchery, constructed at a cost of $225,000, is a provincially-operated facility designed to produce steelhead and anadromous cutthroat fry. Completed late in 1982, this facility is now in its initial year of operation with 1983 brood adults on hand. In addition, three offsite pen rearing operations are under the direction of this facility. They are located in North Saanich, Lake Cowichan, and Black Creek near Courtenay. Eggs from several steelhead and cutthroat stocks will be incubated and the resulting fry reared to approximately two grams prior to release into predesignated streams, or to about five grams before being transferred to a secondary rearing facility for smolt production. The first releases from this facility will take place in summer 1983.

Early in 1982, anadromous cutthroat adults were collected from six river systems. The eggs were shipped to Fraser Valley trout hatchery in Abbotsford for incubation and preliminary fry rearing to a size suitable for pen culture (5 g). All eggs were water-hardened in an antibiotic, erythromycin phosphate, prior to transfer to the incubation site. The eggs were then given a ten minute dip in Wescodyne solution (100 ppm) before being incubated.

Cowichan River steelhead were held at an egg incubation/fry rearing site located on North Cowichan Municipality property on Boys Road in Duncan. After tagging, these fish were transferred for extended rearing to the Lake Cowichan pen rearing site.

Adult captures were accomplished through a variety of techniques. Angling was the most common method; however, seining proved very successful in at least one system. Trapping, seining, electrofishing, and angling were all employed in the collection of adult anadromous cutthroat.

The fish culture staff at Vancouver Island hatchery were also involved in releasing steelhead smolts and fry reared at various federal facilities. In all, steelhead were released from five federal and one provincial Fisheries Research location (Keogh River).

Costia resulted in some heavy losses of cutthroat juveniles at the North Saanich pen rearing site in the summer and fall months. High water temperatures were again of concern at all rearing locations during the early stage of the offsite operations. Theft and vandalism at the Lake Cowichan pen rearing site resulted in a drastic reduction in the number of smolts released in 1982.

With completion of the Vancouver Island hatchery, it is now possible to delay the transfer of fish to the off-site rearing locations until water conditions are more suitable, in October. To date, steelhead from four river systems are being held at Vancouver Island hatchery. In addition, anadromous cutthroat trout adults have been collected from three systems.

In 1983, as many as ten different rivers are expected to be enhanced with steelhead and cutthroat trout reared at the Vancouver Island hatchery.

Contact: Neil Todd, Superintendent of Hatcheries, Fish and Wildlife Branch, Victoria; Dale Larson, Supervisor, Vancouver Island Hatchery, Fish and Wildlife Branch, Duncan.

Chemainus River Hatchery

The remnant stock of chinook salmon (50 adults in 1977) in the Chemainus River has been enhanced since 1979 by Apex Bio-Resources. This company owns a small hatchery, used in connection with their aquaculture project on the Chemainus River, located approximately 32 km north of Duncan. During 1982, this company terminated commercial operations and was subsequently replaced by Sea Spring Salmon Farms. This company continued the contract with SEP to produce chinook juveniles for release. In addition, coho enhancement was added to the contract, with the intent of rearing these fish to the fed fry stage (approximately 5 g by late June) and releasing them in the upper Chemainus River. The fry would then rear naturally until they become smolts and migrate to sea in spring 1983.

The 1981 egg-take produced a release in 1982 of 13,720 chinook smolts and 26,296 fed coho fry. The 1982 egg-take was much larger than the 1981 egg-take, because the first adults returned from this project. The targets of 200,000 chinook eggs and 75,000 coho eggs were easily obtained. This stock is now well on its way to recovery, and early evidence suggests that this particular chinook stock contributes significantly to the Georgia Strait troll fishery.

Contact: Dave Barrett, Head, South Coast Unit, Enhancement Operations.

Nanaimo Community Development Project

This project, located near the mouth of the Nanaimo River, is responsible for the enhancement of Nanaimo River stocks which include spring and fall chinook, coho, and chum salmon, as well as steelhead and cutthroat trout.

The project employs seven people full-time and one person part-time. In 1982, the Nanaimo project operated its hatchery on the Nanaimo River to incubate and rear chum, chinook, coho and steelhead trout. A crew was hired through the job creation program to supplement ongoing activities at the Nanaimo project.

Field studies were carried out in 1982 to obtain baseline information on salmon stocks. Through electroshocking and smolt-trapping techniques, the Nanaimo project staff determined the timing of outward migration, the survival, growth rates, and stocking densities for coho and steelhead.

Major hatchery work in 1982 included the construction of two raceways to increase rearing capacity in the spring and to hold adult brood stock in the fall.

Contact: Barry Cordocedo, Project Coordinator, Special Projects Division.

Little Qualicum Project

This facility is located on the Little Qualicum River, 2 km north of Qualicum Beach. It includes a spawning channel for chum salmon and a rearing channel for juvenile chinook salmon and steelhead trout.

The spawning channel, which is 4.16 km long and 7.5 m wide, can accommodate 50,000 spawners and produce an estimated 59 million chum fry annually. It was hoped that the channel would be in full production by 1984; however, adult escapements to the river have been below normal since the project was started in 1979. It now appears that it may take an additional four years to reach this goal.

The rearing channel has a capacity for 1.5 million chinook smolts and 25,000 steelhead smolts. All fish for the rearing program are supplied from the Big Qualicum hatchery. Therefore, it has been possible to operate at full production since the project started in 1980. A good number of chinook jacks returned during the fall of 1981, and the first steelhead returns occurred in December 1981, indicating a promising future for chinook and steelhead enhancement at Little Qualicum.

This project has the capacity to contribute over 150,000 chum, 30,000 chinook, and 1,000 steelhead to the sport, commercial, and native food fisheries annually.

Special activities carried out in 1982 were aimed at increasing chum production. The chum rearing program was expanded and resulted in the release of 2.7 million fed fry. A new approach was taken to increase utilization of the spawning channel by adult chum. In addition to fish which entered the channel voluntarily, nearly 7,000 chum were captured at the river-mouth and airlifted by helicopter to the channel.

Contact: Grant Ladouceur, Stock Enhancement Officer; Dave Barrett, Unit Head, Vancouver Island, Enhancement Operations.

Big Qualicum Project

The Big Qualicum River project is located approximately 60 km north of Nanaimo. It was developed to increase the production of native stocks of chum, coho, and chinook salmon, as well as steelhead trout. The first stage of the project, completed in 1963, included the construction of facilities to allow year-round regulation of water flows and to provide a degree of water temperature control during the summer and fall. The second phase, completed between 1964 and 1967, involved the construction of two artificial spawning channels. The last stage in development was the hatchery program, which began in 1968.

Flow control has more than doubled the egg-to-fry survival for all species. However, chum salmon have derived the most benefit from this situation, since their production is not limited by available rearing area in the river.

The first spawning channel was originally built to accommodate pink salmon, but was later used as a chum and chinook spawning channel. Design problems resulted in poor egg-to-fry survival; however, the channel was modified and is now used to rear hatchery chinook and coho. The second spawning channel, designed specifically for chum salmon, has been extremely successful. This channel will accommodate 25,000 spawners and produce up to 27 million fry annually for an egg-to-fry survival rate of approximately 75 percent.

The hatchery program at Big Qualicum was started as an experimental installation to test various techniques for future hatchery plans in other locations. After 1971, the hatchery became production-oriented. Since that time, it has been expanded to become one of the largest production facilities in B.C. The present incubation capacity is 20 million eggs, and the rearing capacity is for one million coho smolts, three million chinook smolts, and 75,000 steelhead smolts. Over five million coho and chinook eggs are sold each year to privately-owned fish farms, some are used for research projects and still others are donated to public involvement projects. Also, two million chinook and 500,000 coho fry are used for the recolonization of seven local streams. Steelhead smolts are produced for release into the Big Qualicum River as well as a number of other streams including the Little Qualicum, Englishman, Chase, and Millstone Rivers.

The Big Qualicum project is currently operating at full capacity and contributes approximately 150,000 chum, 100,000 coho, and 90,000 chinook to the sport and commercial fisheries as well as 70,000 fish (most of which are coho) to the Indian food fishery each year. The value of this annual catch has been estimated at $8.5 million.

Studies carried out between 1979 and 1981 indicated that predatory birds can capture up to 25 percent of chinook smolts released from Big Qualicum hatchery. Most of this interception occurs before the smolts reach the sea. In 1982, release strategies were changed:

- release dates were delayed to avoid migratory bird predators
- releases were made at dusk on a day when tides were high the following morning
- mass releases were made to reduce the probability of predation on individual smolts.

As a result of these changes, predation on chinook smolts was reduced to an estimated 1.2 percent.

The pilot chum rearing program in 1982 studied the effects of larger release size on adult production. The pilot will be carried out for the next few years and, if it proves successful, will be expanded to a larger scale. The first adult returns are expected in 1985.

Contact: Grant Ladouceur, Stock
Enhancement Officer,
Enhancement Operations.

Puntledge River Hatchery

Puntledge River hatchery is located 2 km west of Courtenay. The main hatchery site has been operational since 1979, with full production slated for 1989. The hatchery complex consists of three sites: the upper site, lower or main site and Tsolum River project.

The upper site is located 9 km upstream from the main site on the Puntledge River. It facilitates the capture of adult summer chinook and summer steelhead and the rearing of summer chinook, coho and summer steelhead.

The lower site accommodates all incubation, the capture of fall chinook, coho, pink and chum as well as the rearing of fall chinook, pink, chum and winter steelhead.

The Tsolum River project is a satellite of Puntledge hatchery and is operated from the main site. This project is designed for the trapping and holding of adult pink and the rearing of Tsolum River pink salmon.

In 1982, the original target of 1.5 million summer chinook eggs was met. One million fry will be released in 1984.

An abundant return of chum salmon entered the Puntledge system in 1982, with the first hatchery returns of 3-year-old fish. It is impossible to determine the number of hatchery returns in 1982, as none of the 1979 brood were marked. Nineteen eighty-two marked the first year since the hatchery program was started in 1979, that full chum production was achieved.

Coho enhancement was started in the spring of 1977, when 24,000 wild fry were trapped in Morrison Creek, a tributary of the Puntledge River. These fry were reared at the hatchery for one year, then released in May 1978. From this first release, 1,800 adults returned. The adult return in 1982 was 22,000 fish to the river system, and 60,000 fish caught in various fisheries.

With these successful coho returns, colonization of Comox Lake and its tributaries is possible, while still maintaining a production target of one million coho smolts annually.

In June 1982, 2.5 million fed coho fry were released in the Comox watershed at a weight of 2 grams.

Fall chinook enhancement has proven difficult to achieve, owing in part to heavy commercial and sport fishing pressures on this population and the resultant lack of returns of adequate brood stock to the river. A consistent increase has been experienced over the past three years, but only 300,000 eggs were collected in 1982. The production target is for a release of four million fry annually by 1989.

Tsolum River Project

The Tsolum River project was not operational in the fall of 1982, as only three female and five male pink salmon returned. Runs of pink salmon to Vancouver Island streams occur only in odd years.

Contact: Harry Genoe, Stock
Enhancement Officer,
Enhancement Operations.

Quinsam River Hatchery

Quinsam River hatchery is located about 5 km west of Campbell River. Operational since 1974, it is currently at full production. A pen-rearing program for pink salmon was continued in the Campbell River estuary in 1982.

All chinook salmon that return to the Quinsam River are of hatchery origin, hatched from eggs taken from Campbell River stock. In 1982, 1,500 chinook averaging 10-20 kg spawned naturally in the Quinsam River. Another 524 chinook were taken to the hatchery for brood stock. This "natural" run of chinook, which has increased significantly over previous years, is an important corollary of hatchery production. A creel census in 1982 revealed a sport catch of 224 chinook salmon. Of these, eight were kept, and 216 were released. Chinook returns to the Campbell and Quinsam Rivers in 1982 totalled 2,782 fish. Also in 1982, 22,399 adult coho returned to the Quinsam River hatchery. As well as a production facility, Quinsam River hatchery is also the site for applied research in fish culture techniques.

In the colonization program for coho salmon, 296,063 fry were released upstream in the fall of 1981. Fourteen percent of these migrated during the spring of 1982. Approximately 34 percent of these smolts were marked at the Quinsam River fence to evaluate their survival and contribution to the fisheries.

In the fall of 1982, 263,000 reared coho fry (10.0 g) were transported by helicopter and released in the Upper Quinsam River at a density of about 15,100 fish per kilometre.

Evaluation of a dry-feed diet has been carried out at Quinsam hatchery since 1975. Starting with the 1976 brood coho, a dry diet formulated by the West Vancouver Laboratory has also been tested.

A prooram studying the effects of rearing density on ocean survival has been in place starting with 1981 brood coho. This program involves research personnel from the West Vancouver Laboratory as well as staff at the Quinsam hatchery. Four Burrows ponds are in use and contain loadings of 104,000, 95,757, 85,000, and 72,000 coho fingerlings respectively. These four groups have been marked and will be released in May 1983.

In conjunction with the rearing density study, personnel of the Pacific Biological Station have marked additional coho to gather more information on the effects of size and time of release on ocean survival. One group of coho in the rearing density study was selected and marked in three groups each of small, medium, and large fish. These nine groups of coho will be released in May 1983.

Three groups of chinook smolts marked according to their size (small, medium, and large) were released at four different times in the spring of 1982 to determine the best time of release and optimum size for chinook produced at Quinsam hatchery. This is the first of several size and time studies planned for chinook salmon. The collection and assessment of these data will continue throughout 1983. This information will contribute to improved chinook survival and greater contribution of chinook to the sport and commercial fisheries.

In 1982, a total of 3,278,000 pink salmon eggs were incubated in Heath trays at Quinsam River hatchery. After these eggs hatched, the alevins were surface-planted into gravel boxes. After emerging as fry in 1983, approximately 500,000 pinks will be transported to the Campbell River estuary and reared in aluminum net pens. The remaining fry will be released directly into the Quinsam River.

The adult production (catch and escapement) anticipated from 1982 releases of fry and smolts from Quinsam River hatchery is 28,000 chinook, 150,000 coho, 81,000 pink and 1,000 steelhead trout.

Contact: Jim Van Tine, Stock
Enhancement Officer,
Enhancement Operations.

Bear River Hatchery

The Bear River hatchery is located northeast of the town of Campbell River on Amor de Cosmos Creek, which drains McCreight (Bear) Lake into Johnstone Strait.

The original facility was built by the Fisheries Research Branch as an experimental project to test the introduction of odd-year runs of pink salmon to streams supporting only even-year runs. In 1980, this facility was turned over to the Salmonid Enhancement Program for production purposes.

In spring 1982, 1.8 million pink fry were transported from Quinsam River hatchery and released into the Bear River after they adjusted to local water conditions.

In 1982, pens were set up at the mouth of the Bear River to facilitate the capture of pink brood stock with seine nets.

Assessment of the adult pink escapement in 1982 indicated that insufficient brood stock was available for Bear River hatchery to operate in 1982/83.

In 1983, a total of 41,000 pink salmon (catch and escapement) are expected to return to the Bear River facility.

Contact: Jim Van Tine, Stock
Enhancement Officer,
Enhancement Operations.

Nimpkish Hatchery

The Nimpkish project, located on Willow Creek at the southwest end of Nimpkish Lake, is designed to increase the sockeye, chum, chinook and coho stocks of the Nimpkish River watershed and to contribute to the commercial, sport and native food fisheries in the area.

In 1982, the Nimpkish Band had a contract to collect adult brood stock to supply up to three million sockeye, one million chum, 100,000 coho and 100,000 chinook eggs and to incubate, rear and release the resultant fry. Saltwater ripening of the chum brood stock again caused questionable egg viability, which was reflected in the 55 percent survival rate from egg to release. The crew collected a few chinook and coho adults to gain experience in handling these two salmon species at their facility.

The Nimpkish Band plans to increase the chinook and coho egg-takes in 1983/84 and will move their chum salmon facility to the Cheslakees site near the mouth of the Nimpkish River to take advantage of the warmer water available at this site for the ripening of chum adults. This water will also accelerate the development of the chum fry to ensure that they have the same migration timing as the wild fry.

This project provides employment for up to six members of the Nimpkish Band.

Contact: George Bates, Community
Advisor, Special Projects
Division.

Northern Vancouver Island Salmon Enhancement Association (NVISEA)

The Association operates Quatse River hatchery located in a campsite just off the Coal Harbor Road, and Stephens Creek hatchery located on Stephens Creek on the outskirts of Coal Harbor.

The NVISEA projects are part of the $700,000 Special Employment Initiatives Program, which has provided $225,000 to fund salmonid enhancement activities in the Port Hardy area. Ongoing operating costs of this project after March 1984, will be paid by CEDP. Both projects are designed to increase chum, pink and coho stocks on both the east and west coasts of northern Vancouver Island and to contribute to the commercial, sport and native food fisheries.

The Northern Vancouver Island Salmon Enhancement Association had an $89,000 contract in 1982 for:

- site acquisition through 10-year leasing arrangements at both sites
- construction of road access and site clearing for the Stephens Creek site
- installation of hydro and telephone at both sites
- purchase and setup of buildings at the Quatse and Stephens Creek sites
- site levelling and installation of domestic sewer and water at the Quatse hatchery
- renovations to both hatchery buildings
- completion of drainage ditch at Stephens Creek
- surveys of water lines and dam repairs at Stephens Creek
- installation of fencing around both hatcheries
- purchase of incubating equipment and rearing troughs for both sites
- setup of interior incubators at both sites
- purchase of on-site plumbing equipment and piping
- revegetation of eroded banks and disturbed areas around both hatchery sites.

In 1983, a $121,000 contract with the NVISEA is expected to provide 2.5 person-years of employment for Association staff and additional employment for local contractors to complete the construction of the two facilities.

Staff and volunteers from the Port Hardy and Coal Harbor areas will be involved in collecting brood stock for the two facilities. Quatse hatchery will have a capacity for 900,000 chum, 250,000 pink and 300,000 coho eggs. The Stephens Creek hatchery will be able to handle 750,000 chum, 100,000 pink and 200,000 coho eggs.

It is anticipated that some members of the Quatse, Tsulquate, and Fort Rupert Indian Bands will be employed in brood stock capture, incubation, rearing and fry release activities associated with these facilities and will attend SEP training courses offered by North Island College at the Quatse River site.

Contact: George Bates, Community
Advisor, Special Projects
Division.

Provincial Status Report

Steelhead Stock Assessment

Since the inception of SEP in 1977, there have been a variety of steelhead stock assessments. The objective of this program is to assess the size and productivity of a number of indicator stocks and to adjust angling regulations and harvest accordingly. Activities have included regular snorkel surveys on representative summer and winter steelhead streams, creel surveys, adult and juvenile marking programs, juvenile habitat surveys, smolt enumeration, commercial fishery sampling, habitat capability assessment, life history interpretation, and catch data analysis.

As results were compiled, it became evident that steelhead stocks in virtually every accessible stream were small, readily harvested, and in desperate need of protective regulations. Harvest restrictions were increased from 1976 through 1979, generally in parallel with newly collected data. Summer steelhead have been subject to catch-and-release regulations since 1977. Most winter steelhead runs, somewhat less susceptible to overexploitation, were the subject of catch-and-release regulations from December 1 through March 1, commencing in 1980. Concurrently, daily, monthly and season catch limits for wild steelhead in open areas and times were reduced to one, two, and five fish, respectively.

The stringent harvest controls have resulted in a dramatic increase in summer steelhead counts in all experimental streams after only one generation. It remains to be seen what additional response will materialize from these larger escapements. Winter steelhead runs are expected to follow suit, although one or two more years will be required to judge the first-generation response for these stocks. Fry abundance among the winter stocks increased sharply in the first summer following the introduction of catch-and-release regulations.

Preliminary habitat capability analyses have now been completed for most important steelhead streams on Vancouver Island. Not surprisingly, the study confirmed that many of these streams were underutilized during the mid to late 1970s. In some cases, it appears that logging has harmed trout habitat to the point that steelhead survival in fresh water is so low and variable that no harvestable surplus should be contemplated. It is anticipated that the habitat capability analysis, together with catch data and stream flow records, will permit definition of stream and stock-specific harvest quotas.

Contact: Bob Hooton, Fisheries
Biologist, Fish and Wildlife
Branch, Nanaimo.

Hatchery Steelhead Production

Beginning at Robertson Creek hatchery and Big Qualicum facilities, the hatchery steelhead program on Vancouver Island has grown in accordance with angler demand and the increased restrictions on harvest of wild steelhead. The rapid expansion of steelhead smolt and fry production programs has followed closely the timetable and goals established in the early years of SEP.

The steelhead culture program focuses on both fry and smolt releases. Smolts are released when an early return of harvestable adults is desired.

Fry releases are generally reserved for habitats where natural recruitment is impossible because of barriers to migration. All hatchery smolts are identified by a missing adipose fin, whereas hatchery fry are indistinguishable from wild fry. Different harvest regulations apply to adults returning from each group.

By fisheries policy developed in consultation with anglers, the steelhead hatchery program is dependent on wild brood stock. In most situations, this policy has required difficult and time-consuming collection procedures. Many new techniques and innovations have been developed and efficiency has improved greatly. In 1982, 678 wild steelhead adults were collected, of which 537 were retained for spawning purposes. The direct cost per wild egg produced was estimated at $0.040 in 1982, down substantially from $.065 in 1980 and $.071 in 1981. This cost is interpreted as that required to provide a consumptive sport fishery while still maintaining the genetic integrity of steelhead stocks.

Hatchery smolt releases have increased from a total of 50,000 smolts in three streams in 1976, to 450,000 smolts in 15 streams in 1982. The ultimate production goals of 500,000 smolts and 500,000 fry will be achieved in 1984. Adult returns from these releases will occur through the period 1985 to 1988. Most fry production will be realized through the new Fish and Wildlife hatchery at Duncan.

Contact: Bob Hooton, Fisheries
Biologist, Fish and Wildlife
Branch, Nanaimo.

Vancouver Island Sea-Run Cutthroat Trout

The restoration of Vancouver Island cutthroat trout from near extinction has been the goal of this program. The adoption of strict angling regulations, coupled with various habitat and fish culture techniques, has provided signs of improved angler success in 1982. The sea-run cutthroat trout program on Vancouver Island has proceeded over the past year in three areas.

a) Hatchery Evaluation

The primary enhancement technique for cutthroat trout over the past three years has been the release of hatchery-reared smolts. The evaluation program, implemented in 1980 to assess the biological and recreational success of smolt stocking on the Gorge waterway in Victoria, continued in 1982.

The assessment program involved downstream trapping of both wild and hatchery cutthroat trout in Colquitz Creek. The release of hatchery smolts was timed to coincide with optimum water flows and temperature regimes in early April. Migration patterns reflected the size of the smolts at the time of release, with the larger smolts moving downstream early in April at the same time as the large two-year-old wild smolts. The smaller hatchery smolts moved downstream in May, with a total of 83 percent of smolts migrating successfully to salt water.

The Gorge waterway recreational fishery is oriented to sea-run cutthroat trout. In 1982, a total of 1,080 anglers were contacted during the creel survey (held over 3.5 months). Total effort on the Gorge was 5,968 hours of fishing, and resulted in a catch of 1,100 cutthroat trout. Ninety-seven percent (of trout caught) were of hatchery origin. These results, in comparison with the 1981 creel results, showed a significant decrease in the survival of hatchery-released smolts from a high in 1981 of a 12 percent return to the fishery, to a harvest of only 5 percent in 1982.

One percent of the total number of hatchery smolts released returned as adults to Colquitz Creek. Preliminary scale analysis of adults captured in the fishery and those returning to the upstream fence indicates that two size groups of hatchery-released smolts contributed to the adult catch and escapement. The highest survival rates for hatchery cutthroat originated from large smolts released early in the migration period, and smolts released later in the migration period at a mean size of 70 and 50 g, respectively.

b) Small Stream Enhancement

Numerous public projects involving small stream enhancement of cutthroat trout were encouraged over the past year.

They ranged from supplementing low flows in a nursery stream in Ladysmith to releasing cutthroat fry into barren tributaries of the Tsolum River.

c) Stock Assessment

The primary method of assessment of adult stocks on Vancouver Island has been the snorkel survey. Since 1979, the Oyster River, the Little Qualicum River and the Koksilah River have been surveyed to reveal trends of population stability.

Snorkel surveys in 1982 showed a two- to three-fold increase in wild adult populations over 1980 counts.

In 1983, the hatchery evaluation program will continue to assess the impact of smolt stocking on sea-run cutthroat trout fisheries on Vancouver Island. A report on the success of hatchery cutthroat smolt releases is being prepared. An attempt will be made in 1983 to identify habitat production capability for small streams on Vancouver Island, to better predict adult returns. This analysis will assist in the development of a comprehensive sea-run cutthroat management plan.

Contact: Peter Law, Fisheries
Biologist, Fish and Wildlife
Branch, Nanaimo.

Job Creation Projects

Habitat Assessment Office Team

The Job Creation Unit, in conjunction with the Aquatic Studies Branch of the Ministry of Environment, initiated a project at the Aquatic Studies Branch office in Victoria. The goal of this project was to utilize existing habitat assessment information collected by job creation crews to prepare habitat maps and summaries. Three people advised field crews on further investigations.

Goldstream Fry Satellite Project

A job creation project was sponsored by the Amalgamated Conservation Society to construct a small satellite hatchery on the Goldstream River (Japan Gulch) near Victoria. The goal was to increase fish production in the Victoria region and to provide an educational building for local school students. Four people constructed the 6.4 m X 9.5 m building for egg-takes and incubation. Several gravel incubation boxes were constructed, and fry rearing tubs were also installed.

Cowichan River Watershed Project

The Cowichan Valley Regional District sponsored a large job creation project on the Cowichan River near Duncan. The 36 participants:

- mapped and measured the tributaries flowing into Lake Cowichan and the Cowichan River from the lake east to Skutz Falls
- carried out comprehensive stream enumerations on the Cowichan, Koksilah and Chemainus Rivers, and various smaller streams such as Garnett Creek at Cherry Point
- salvaged an estimated 60,000 coho fry, including 10,000 fry which were salvaged from the Koksilah system and released above Marble Falls
- removed obstructions from various watersheds, to open up previously nonproductive areas of streams
- improved numerous side channels, including those at the Rotary Park and Bible Camp, by cleaning spawning gravel, stabilizing stream banks, and plac-

ing boulders and logs to improve both spawning and rearing habitat

- cleaned the fishway on the Koksilah River of gravel to assist migrating adult salmon
- constructed brood stock holding pens
- captured coho brood stock and transported adults to holding areas; planted 100,000 coho eggs in incubators
- constructed two incubation boxes and water intakes on the Koksilah River. A total of 50,000 coho eggs were incubated at Grants Creek. On Sutton Creek in the Lake Cowichan watershed, a total of 50,000 coho eggs were incubated
- constructed and improved access trails along the Cowichan River
- assisted in the construction of an incubation facility at the Shawnigan Lake Boys' School.

Cowichan Indian Band Project

The Cowichan Indian Band sponsored a job creation project to implement various fisheries activities and to assist with their hatchery located on the Cowichan River near Duncan.

Eleven people were involved with habitat inventory and stream improvement of several side channels of the Cowichan River. On the hatchery creek, the main channel was cleared of debris and the banks reinforced. At Major Jimmy's side channel, areas of silted gravel were cleaned to provide an unrestricted flow of water. The crew also dipnetted for chinook and coho brood stock at Skutz Falls, seined for adult chinook just below Lake Cowichan, beach seined for chum below the Silver Bridge, constructed adult holding pens and assisted in installing fish traps at Skutz Falls. A small fish ladder at the White Bridge was cleared of gravel and debris.

Westholme Channel Improvement

The Halalt Indian Band and the Small Projects Unit sponsored a job creation project on the Westholme side channel near Chemainus. Four people sorted and placed shot-rock on the banks of the channel to prevent further erosion. The crew was also involved in adult enumeration and scale sampling of adult chums in the channel.

Nanaimo Indian Band Project

The Nanaimo Indian Band, in conjunction with the Nanaimo River Salmonid Enhancement project, implemented a job creation project on the Nanaimo River watershed.

The five people were involved in several activities. Support pads for gravel incubators and a net rack were constructed. Capilano troughs and waterlines were dismantled and relocated outside the hatchery. Adult collection fences were reconstructed and maintained on Haslam and Hong Creeks, and at the outlet of the first lake on the Nanaimo River. The crew also assisted in brood stock capture, egg-takes, and the shocking and picking of dead eggs.

Millstone Fish Ladder

The Nanaimo Fish and Game Club, in conjunction with the Public Involvement Program and the provincial Fish and Wildlife Branch, implemented a job creation project on the Millstone River at Bowen Park in Nanaimo. Five people built forms and poured concrete in constructing the fishway to bypass a falls on the river.

Qualicum Beach Stream Enhancement Project

A job creation project was sponsored by John Van Herwaarden to determine the suitability of stocking coho fry in local streams and to conduct various fisheries activities in the Qualicum Beach area.

Ten people used the Semi-Slaney stream survey method to determine the length and wetted width of each stream and were involved in identifying obstructions, fall and winter rearing habitat; recording flows; identifying natural water storage areas and determining access points and land status. The creeks surveyed included Nanoose Craig, Morning Star, French Beach, Whiskey, Kincade, Anne, Nile, Thames and several unnamed creeks in the Qualicum area.

The crew was also involved in spawning counts, trail construction on Beach and Kincade Creeks, obstruction removal on Whiskey Creek and maintenance of the fishway at French Creek near Coombs.

The crew assisted in the construction and installation of a fish trap and holding box at Beach Creek. A total of 20,500 coho eggs were taken from Beach, Crocker, and Hamilton Creeks and transported to the Big Qualicum hatchery for incubation. The eggs will be incubated separately and the fry returned to their native streams.

At the Little Qualicum hatchery, the crew assisted with dead pitch, scale and egg retention sampling, feeding of steelhead fry, and road maintenance.

Qualicum River Project

A job creation project was sponsored by the Qualicum Indian Band to assist the Big Qualicum River hatchery.

Ten people helped in the construction of an incubation building, upgraded an equipment storage area, improved access trails and slashed a road right-of-way along the Qualicum River.

The crew also caught and transported Big Qualicum adult and jack coho, chinook and chum for cold storage. The fish were subsequently distributed to various Indian Bands on Vancouver Island to supplement the native food fishery and so relieve fishing pressure in southern Vancouver Island streams.

Puntledge River Hatchery Project

Eight people assisted in a wide range of activities at the Puntledge River hatchery in Courtenay.

The crew helped with brood stock capture, egg-takes and incubation, adult mark recovery and dead recovery, planting and picking of eggs, raceway preparation and the marking of 27,000 steelhead fry.

Comox Valley Fish Habitat Improvement

The Courtenay Fish and Game Club sponsored a job creation project on the Courtenay River. Eight people were involved in developing a side channel to provide additional spawning and rearing area for salmonids.

Quinsam River Hatchery Project

The Campbell River Estuary and Watershed Society sponsored a job creation project at the Quinsam hatchery in Campbell River. Fifteen people were involved in the construction of a storage shed and poured concrete pads for rearing troughs.

The crew assisted in mark recovery and adult sampling, the marking of smolts and fry and a creel census of the steelhead, chinook and coho caught in the Quinsam River.

Quadra Island Stream Enhancement Project

The Quadra Island Salmon Enhancement Society initiated a job creation project on Quadra Island streams.

A crew of eight assisted in various activities at the hatchery on Hyacinthe Creek. A storage shed and outdoor rearing shed were constructed. An adult counting fence was constructed and installed at Village Bay Lake narrows. Maintenance around the hatchery included the replacement of the adult holding tank lining, incubator preparation, site preparation, landscaping, and the manufacture of building materials. Stream inventory was completed on 13 creeks in the Village Bay Lakes watershed. The crew also assisted in brood stock capture, egg-takes of chum and coho at the Hyacinthe Creek hatchery, and in the removal of dead eggs.

Contact: Tony Stein, Project
Developer, Job Creation Unit,
Special Projects Division.

Table 20

Public Participation Projects

EAST COAST VANCOUVER ISLAND PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1982	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1982 Releases
Millstone River System	Nanaimo Fish & Game Protection Assn.	120	3	fishways, stocking, construction	coho	50,000		600
						Transplant from Nanaimo River.		
Craig Creek	French Creek, Boat Owners' Association	10	4	stream improvement, feeding	coho			
French Creek	Parksville-Qualicum Rod & Gun Association	25	2	incubation	coho	No eggs taken in 1981.		
Beach Creek	Parksville Secondary School	30	3	incubation, incubation in school, stream improvement	coho	19,000	95	228
#1 Supply Creek/ Trent River	Courtenay District Fish & Wildlife Protective Assoc.	10	5	incubation, construction	coho cutthroat	65,000 5,200	65 90	780 182
Roy Creek	Cumberland Chamber of Commerce	5	2	incubation	coho	20,000	80	240
Kitty Coleman Creek	Pacific Trollers Assoc.	18	6	incubation	coho	21,000	95	504
Kingfisher Creek	Haig-Brown Society	10	2	—	—	—	—	—
Drew Harbor Creek	April Point Flyfishing Club	10	4	incubation, fishways, construction	chum	25,000	100	300
Hyacinthe Creek	Quadra Island Salmonid Enhancement Society	20	3	incubation, studies, stream improvement, information, construction	coho chum	180,000 —	90 —	2,700 —
Granite Bay Creek	Granite Bay Conservation Society	—	3	incubation	pink chum coho	80,000 2,400 8,600	80 96	2,000 19 206
						Transplant from Hyacinthe Cr.		

Contact: Bob Hurst, SEP Community Advisor.

Goldstream River	Amalgamated Conservation Society	100	5	incubation, stream improvement, construction	coho chinook	116,000 2,500	65 63	555 495
Goldstream River	Discovery Elementary School	33	2	incubation in school	chum	9,000	65	72
Goldstream River	Shawnigan Lake Boys School	60	3	incubation in school	coho chum	5,000 18,400	55 58	75 147
Colquitz Creek	R. Langford	2	1	brood capture	coho	10,000 From Goldstream PIP hatchery.		150
Tod Creek	Tod Creek Enhancement Society	12	2	stream improvement, feeding	coho	2,000 Transplant from Goldstream PIP hatchery.		30
Reay Creek	Sidney Anglers	25	2	stream improvement, feeding, information	coho	2,000 Transplant from Goldstream R.		30
Shawnigan Creek	Mill Bay & District Conservation Society	12	4	incubation	coho chum	24,372 6,800	43 75	366 6
Cowichan River Estuary	Cowichan Preservation Society	8	1	information		Assistance with display booth and information at Cowichan Valley Fair.		
Glenora Creek/ Norrie Creek	Cowichan Fish & Game Association	16	2	stream improvement		Removal of instream debris.		
Coonskin Creek	Yount Elementary School	30	3	incubation in school	coho	47,500	95	712
Sooke River/ Rocky Creek	Sooke Conservation Society	36	6	incubation, feeding	coho chinook	398,000 38,038	98 96	6,000 913
Sooke River	Demeniel Incubation Group	3	3	incubation, feeding	coho	25,500	63	383
Pachena River	Pacific Trollers Assoc.	15	6	incubation	coho	22,500	50	338
Somass River/ Deer Creek	Alberni Enhancement Society	8	2	incubation	coho	64,350	45	772
Cherry Creek	John Howitt Elementary School	6	1	incubation	coho	4,000	73	60
Beaver Creek	Beaver Creek Elementary School	30	2	incubation	coho	300	9	5
Lost Shoe Creek	Thornton Creek Volunteer Group	30	2	incubation	coho chum	69,000 26,000	95 71	1,035 208
Atleo River/ Anderson Creek	Ahousat Indian Day School, Resource Technology School	4 6	2 1	information, incubation in school, construction	chum	19,000	88	152

Contact: Trevor Morris, SEP Community Advisor.

Table 21

East Coast Vancouver Island SEP Facilities*: Juvenile Releases 1982

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size(g)
Cowichan Band Project						
Chinook	1981	Cowichan R.	58,000	100	25	3.1
Chum	1981	Cowichan R.	700,000	1.4	58	1.19
Vancouver Island Hatchery						
Steelhead	1981	Cowichan R.	3,274	100	5.2[1]	35.2-74.8
Cutthroat	1981	Sandhill Cr.	5,143	100	70.7	80.4-116.1
Cutthroat	1981	Sandhill Cr.	3,828[2]	100	70.7	23.3-100
Cutthroat	1981	Sandhill Cr.	1,755[3]	100	--[4]	57
Cutthroat	1981	Sandhill Cr.	1,677[5]	100	--[4]	22.5
Cutthroat	1981	Colquitz Cr.	17,370	100	--[4]	56.5-79.6
Cutthroat	1981	Colquitz Cr.	393[5]	100	--[4]	21.3
Cutthroat	1981	Colquitz Cr.	411[6]	100	--[7]	9
Cutthroat	1981	Black Cr.	1,126[8]	100	--[4]	13.6
Cutthroat	1981	Black Cr.	4,885	100	--[4]	48.8-74.1
Cutthroat	1981	Oyster R.	2,676	100	--[4]	92.6-126.2
Chemainus River Hatchery						
Coho	1981	Chemainus R.	26,296	0	88	4
Chinook	1981	Chemainus R.	13,730	0	85	6
Nanaimo Community Development Project						
Coho	1981	Nanaimo R.	130,846	26	81	0.7-2.5
Chinook	1981	spring run	2,813	0	75	4.2
Chinook	1981	fall run	11,537	0	55	7.6
Chum	1981	Nanaimo R.	888,000	0	77	0.7
Pink	1981	Nanaimo R.	2,560	0	77	0.9
Steelhead	1981	winter run	65,494	0	83	2
Cutthroat	1981	Nanaimo R.	2,188	100	43	31-44
Little Qualicum Project						
Chinook	1981	L. Qualicum R.	1,411,157	5.8	80	6.9
Chum	1981	L. Qualicum R.	1,446,877	17	75	0.38
Chum	1981	L. Qualicum R.	2,747,809	3.6	70	0.7
Steelhead	1981	B. Qualicum R.	23,534	90	60	54.7
Big Qualicum Project						
Coho	1980	B. Qualicum R.	1,182,746	4.39	87.5	18.6
Coho	1981	B. Qualicum R.	10,000[9]	0	N/A	10.5
Coho	1981	B. Qualicum R.	150,000[10]	0	N/A	0.38-2.4
Coho	1981	B. Qualicum R.	346,950[11]	0	N/A	0.38-0.41
Chinook	1981	B. Qualicum R.	3,394,280	1.5	80.6	6.94
Chum	1981	B. Qualicum R.	47,337,192	0.01	32.8	0.37-1.03
Steelhead	1981	L./B. Qualicum R.	79,805[12]	55.73	76.9	13
Steelhead	1981	B. Qualicum R.	45,831[13]	19.68	61.7	5.3-69
Steelhead	1981	Englishman R.	30,793[14]	62.23	62.7	6.04-53.6

Table 21 (Cont'd)

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size(g)
Puntledge River Hatchery						
Coho	1980	production	1,001,261	6.1	76	20.3
Coho	1980	colonization	203,154	50	82	14.29
Coho	1981	colonization	2,760,757	3.9	92.5	2.5
Chinook	1981	summer run	200,006	25.2	40.8	6.5
Chinook	1981	fall run	106,883	70.2	73.2	5.0
Chum	1981	production	2,369,078	4.6	92.8	1.2
Pink	1981	Puntledge R.	920,298	0	84.7	0.2
Pink	1981	Tsolum R.	713,914	28.4	73.5	0.2-0.58
Steelhead	1981	summer run	26,468	100	46.1	46.7
Steelhead	1982	summer run	20,436	0	87.1	0.98
Steelhead	1981	winter run	38,959	100	49.1	51
Cutthroat	1981	production	250	0	83.3	150
Quinsam River Hatchery						
Coho	1980	production	1,275,831	6.42	56.63	23.98
Coho	1981	colonization	263,063	0	63.58	10.3
Chinook	1981	production	438,406	22.75	58.60	7.92-8.24
Chinook	1981	time & size study	87,300	95.75	58.60	3.02
Chinook	1981	time & size study	92,045	96.83	58.60	6.80
Chinook	1981	time & size study	92,128	97.25	58.60	8.25
Chinook	1981	time & size study	55,585	96.55	58.60	13.02
Chum	1981	study	71,565	0	82.41	0.88
Pink	1981	production	3,293,342	1.84	94.30	0.23
Pink	1981	sea pen	249,000	48.41	94.30	0.45
Steelhead	1981	Quinsam R.	17,589	100	45	77.88
Steelhead	1982	Salmon R.	44,613	0	61	0.81
Steelhead	1982	colonization	48,080	62	64	4.05
Bear River Hatchery						
Pink	1981	Quinsam R.	1,819,812	0	94.3	0.228
Nimpkish Hatchery						
Chum	1981	Nimpkish R.	235,940	21	47	1.5
Sockeye	1981	Nimpkish R.	1,393,000	0	82	N/A

*Includes facilities constructed prior to SEP.

N/A means "not available."

[1] Low survival due to theft and vandalism.

[2] Released into Cowichan River.

[3] Released into Colquitz Creek.

[4] Survival not applicable since additional fish released in 1981.

[5] Released into Prior Lake.

[6] Gradedowns from 1982 brood released into Colquitz Creek.

[7] Survival not applicable since additional fish on hand of this brood.

[8] Released into Miller Creek.

[9] Released into Craig Creek.

[10] Released into Nile Creek.

[11] Released into Hunts Creek.

[12] Transferred to Little Qualicum River.

[13] Some of these were used for research.

[14] Released into Englishman River.

Table 22

East Coast Vancouver Island SEP Facilities: Status at December 1982*

Species	Stock	Brood	Stage	No. on Hand	Expected Release		
					Date	Number	Site
Cowichan Band Project							
Coho	Cowichan R.	82	egg	117,006	May 1983	105,000	Cowichan R.
Chinook	Cowichan R.	82	egg	239,998	June 1983	215,998	Cowichan R.
Chum	Cowichan R.	82	egg	1,012,100	April 1983	910,900	Cowichan R.
Vancouver Island Hatchery							
Steelhead	Cowichan R.	82	presmolt	48,110	May 1983	48,000	Cowichan R.
Cutthroat	Sandhill Cr.	82	presmolt	2,902	April 1983	2,850	Sandhill Cr.
Cutthroat	Colquitz Cr.	82	presmolt	14,044	April 1983	14,000	Colquitz Cr.
Cutthroat	Sooke R.	82	presmolt	3,677	April 1983	3,600	Sooke R.
Cutthroat	Oyster R.	82	presmolt	9,847	April 1983	9,800	Oyster R.
Chemainus River Hatchery							
Coho	Chemainus R.	82	egg	79,100	June 1983	74,200	Chemainus R.
Chinook	Chemainus R.	82	alevin	196,100	June 1983	193,800	Chemainus R.
Nanaimo Community Development Project							
Coho	Nanaimo R.	82	egg	387,104	May-July 1983	348,393	Nanaimo R.
Chinook	spring run	82	egg	35,546	July 1983	31,988	Nanaimo R.
Chinook	fall run	82	egg	148,972	July 1983	134,074	Nanaimo R.
Chum	Nanaimo R.	82	egg	980,135	April 1983	882,121	Nanaimo R.
Steelhead	Nanaimo R.	82	smolt	12,288	August 1983	12,000	Nanaimo R.
Little Qualicum Project							
Chum	L. Qualicum R.	82	egg	43,000,000	April-May 1983	32,000,000	L. Qualicum R.
Big Qualicum Project							
Coho	B. Qualicum R.	81	pre-smolt	1,787,900	May 1983	1,300,000	B. Qualicum R.
Coho	B. Qualicum R.	82	egg	2,100,000	May 1983	1,300,000	B. Qualicum R.
Coho	B. Qualicum R.	82	adult	2,400			
Chinook	B. Qualicum R.	82	egg	6,000,000	June 1983	2,700,000	B. Qualicum R.
Chum	B. Qualicum R.	82	egg	4,219,000	May 1983	2,800,000	B. Qualicum R.
Steelhead	B. Qualicum R.	82	pre-smolt	25,780	May 1983	23,000	B. Qualicum R.
Steelhead	B. Qualicum R.	82	pre-smolt	12,689	June 1983	11,500	Chase, Millstone
Steelhead	Englishman R.	82	pre-smolt	32,910	June 1983	30,000	Englishman R.
Cutthroat	B. Qualicum R.	82	pre-smolt	6,040	N/A	N/A	N/A

Table 22 (Cont'd)

Species	Stock	Brood	Stage	No. on Hand	Expected Release Date	Expected Release Number	Site
Puntledge River Hatchery							
Coho	Puntledge R.	81	smolt	1,085,000	May 1983	1,080,000	Puntledge R.
Coho	Puntledge R.	82	alevin	4,938,000	June 1983	3,000,000	Comox Lake
					May 1984	1,000,000	Puntledge R.
Chinook	summer run	82	alevin	1,431,213	June 1983	1,200,000	Puntledge R.
Chinook	fall run	82	alevin	273,523	June 1983	250,000	Puntledge R.
Chum	Puntledge R.	82	egg	7,559,000	April 1983	7,400,000	Puntledge R.
Pink	Puntledge R.	82	alevin	52,550	Feb. 1983	52,000	Puntledge R.
Steelhead	winter run	82	smolt	31,513	May 1983	31,000	Puntledge R.
Cutthroat	Puntledge R.	82	smolt	2,468	May 1983	2,400	Puntledge R.
Quinsam River Hatchery							
Coho	Quinsam R.	81	smolt	1,076,000	May 1983	1,046,000	Quinsam R.
Coho	Quinsam R.	82	egg	2,227,000	May 1984	1,700,000	Quinsam R.
Chinook	Quinsam R.	82	egg	1,261,000	May 1983	908,000	Quinsam R.
Pink	Quinsam R.	82	egg	3,278,000	April 1983	3,000,000	Quinsam R.
Steelhead	Quinsam R.	82	smolt	23,250	May 1983	23,000	Quinsam R.
Bear River Hatchery							
Did not incubate eggs in 1982 due to insufficient brood stock.							
Nimpkish Hatchery							
Coho	Nimpkish R.	82	egg	10,000	April 1983	8,000	Willow Cr.
Chinook	Nimpkish R.	82	egg	8,000	July 1983	7,500	Willow Cr.
Chum	Nimpkish R.	82	egg	715,000	June 1983	350,000	Nimpkish R.
Sockeye	Nimpkish R.	82	egg	2,300,000	May 1983	1,600,000	Willow Cr.

*Includes facilities constructed prior to SEP.
N/A means "not available."

Table 23

East Coast Vancouver Island SEP Facilities: Surplus Sales 1982*

Species	Amount of Fish (kg)	Eggs (number)	Native Food Fish (pieces)	Value ($)
Big Qualicum Project				
Coho	0	1,775,000	0	17,850.00
Coho	0	98,500	0	--[1]
Coho	0	0	28,632	0
Chinook	0	295,000	0	3,730.00
Chinook	0	638,500	0	--[1]
Chinook	0	0	79	0
Chum	0	110,000	0	1,540.00
Chum	0	65,500	0	--[1]
Chum	0	0	1,112	0
Puntledge River Hatchery				
Coho	38,550.98	0	0	48,201.13
Chum	1,009	0	0	403.60
Pink	1,001.40	0	0	40.06
Mixed	3,075.00	0	0	123.00
Quinsam River Hatchery				
Coho	74,376	0	0	86,386.76
Chinook	0	49,980	0	699.72
Chinook	0	1,000	0	--[1]
Pink	1,000	0	0	500.00
Pink	0	49,860	0	698.04
Pink	0	51,475	0	--[1]
Mixed	3,559	0	0	142.36

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*Includes facilities constructed prior to SEP.

[1] No payment received; provided for research purposes.

Table 24

East Coast Vancouver Island SEP Facilities*: Escapement to Facility 1982

Species	Escapement to Facility	Spawned for Hatchery Stock		% Marked
		male	female	male and female
Cowichan Band Project				
Coho	23[1]	18	26	34.8
Chinook[2]	--	97	114	--
Chum	2,647	229	371	1.7
Chemainus River Hatchery				
Chinook	750	30	45	N/A
Little Qualicum Project				
Chinook	1,083	823	260	2.6
Chum	28,704	14,238	14,466	1.5
Big Qualicum Project				
Coho	39,156	1,374	2,331	4.2
Coho (jacks)	7,700	0	0	3.9
Chinook	3,415	964	1,216	1.3
Chinook (jacks)	495	0	0	1.1
Chum	118,482	600	1,406	1.46
Puntledge River Hatchery				
Coho	22,000	1,513	2,761	4.2
Coho (jacks)	18,500	0	0	3.5
Chinook (summer run)	1,185	384	346	12.8
Chinook (fall run)	347	60	63	19.4
Chum	92,000	N/A	2,948	0
Pink	400	60	49	0
Pink (Tsolum R.)	50	0	0	0
Steelhead (summer run)	175	0	0	85.7
Quinsam River Hatchery				
Coho	22,399	505	1,202	N/A
Chinook	2,032	299	230	N/A
Pink	6,840	2,327	2,395	N/A
Bear River Hatchery				
Pink	500	0	0	5.4

*Includes facilities constructed prior to SEP.

N/A means "not available."

[1] In addition to these, more brood stock was captured in the river.

[2] Captured at Skutz Falls for egg-takes.

Table 25

East Coast Vancouver Island SEP Facilities*: Adult Production

	Expected Production from 1982 Releases			At Full Production	
Species	Total Adult Production	Years of Return	Contribution to Fisheries	Total Adult Production	Contribution to Fisheries
Cowichan Band Project					
Coho	645	1983-1984	359	25,300	14,102
Chinook	776	1983-1986	543	10,800	7,600
Chum	11,040	1984-1986	4,857	28,800	12,672
Vancouver Island Hatchery					
Steelhead	131	1983-1985	65	1,390	1,251
Cutthroat	3,926	1983-1985	2,630	3,500	4,050
Chemainus River Hatchery					
Coho	394	1983-1984	230	700	390
Chinook	412	1983-1986	337	4,500	3,167
Nanaimo Community Development Project					
Coho	1,356	1983-1984	756	13,500	7,550
Chinook	430	1983-1986	301	10,800	7,600
Chum	14,208	1984-1986	6,251	14,400	6,336
Pink	64	1983	38	N/A	N/A
Steelhead	239	1984-1985	119	2,800	1,425
Cutthroat	219	1984-1985	131	1,400	938
Little Qualicum Project					
Chinook	42,335	1983-1986	29,668	40,000	28,149
Chum	66,531	1984-1986	29,273	367,000	161,480
Steelhead	942	1984-1985	471	1,200	600
Big Qualicum Project					
Coho	185,163	1983-1984	103,320	202,000	112,591
Chinook	103,997	1983-1986	72,880	90,000	63,335
Chum	389,398	1984-1986	171,335	349,000	153,560
Steelhead	2,970	1984-1985	1,485	6,600	3,280
Puntledge River Hatchery					
Coho	191,607	1983-1984	106,916	128,000	71,344
Chinook	8,315	1983-1986	5,827	151,000	106,262
Chum	46,468	1984-1986	20,445	120,000	52,800
Pink	23,679	1983	14,207	10,000	6,000
Pink[1]	17,860	1983	10,716	80,000	48,000
Steelhead	2,483	1984-1985	1,241	4,000	2,000

Table 25 (Cont'd)

Species	Expected Production from 1982 Releases			At Full Production	
	Total Adult Production	Years of Return	Contribution to Fisheries	Total Adult Production	Contribution to Fisheries
Quinsam River Hatchery					
Coho	7,890	1983-1984	4,402	162,000	90,296
Chinook	22,963	1983-1986	16,092	30,000	21,112
Pink	134,064	1983	80,438	156,000	93,600
Steelhead	1,470	1984-1985	764	1,000	500
Cutthroat	--	--	--	200	134
Nimpkish Hatchery					
Coho	--	--	--	6,750	4,725
Chinook	--	--	--	5,405	3,672
Chum	1,889	1984-1985	868	10,800	4,968
Sockeye	23,335	1985-1986	13,067	205,300	114,940

*Includes facilities constructed prior to SEP.
N/A means "not available."
[1] Production at Tsolum River satellite facility.

Central Coast

1. *Coho brood stock for the Hartley Bay Band project.*

2. *Snootli Creek hatchery at Bella Coola was expanded in 1982.*

3. *Kitimat hatchery building, rearing channels and exit channel (foreground).*

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Central Coast

Bella Bella Hatchery

This hatchery is located on Campbell Island in the central coast region. This chum hatchery is the focus for training of four full-time employees of the Bella Bella Band Council, which operates the hatchery under contract to SEP. The facility will increase chum salmon available to the central coast commercial fisheries and native food fisheries.

In 1982, the Bella Bella project collected approximately 930,000 chum eggs from a donor stream located 6 km from the hatchery site. The eggs were incubated first in Atkins boxes, then transferred to new aluminum upwelling boxes developed by the SEP's Small Projects Unit.

A major reorganization of the secondary incubation and rearing facilities took place at the hatchery in 1982, with the addition of six new rearing troughs, two upwelling keeper boxes and two rearing tubs. The facility now has the capacity to handle up to 2.5 million chum eggs and rear 100,000 coho to five-gram size.

In 1982, 525,000 fed chum fry were released from sea pens in McLoughlin Bay. Additional sea pens were purchased this year to accommodate up to 1,000,000 chum fry.

As the Bella Bella hatchery is a remote facility with difficult access, it requires 24-hour staffing from the time of egg-takes in late September through to fry emergence and release in late April.

A water quality monitoring program was continued this year at Deer Pass located approximately 16 km from the village of Bella Bella. This information will be used to assess the physical characteristics of the watershed for suitability of development of a second hatchery in the Bella Bella area.

In 1982, Small Projects Unit installed a 5-cm pipeline from Deer Pass Lake to a small 10,000-egg incubator located near the mouth of the Deer Pass Creek. Approximately 7,000 chum eggs were successfully incubated at this site.

In 1983, the Bella Bella Band Council expects to release approximately 700,000 fed chum fry from the sea pens at McLoughlin Bay. The hatchery set 1983 targets of 2.5 million chum eggs and up to 100,000 coho eggs. In addition, the crew expects to salvage up to 50,000 coho fry from nearby streams during periods of low flow.

Construction of a storage shed and rewiring of the hatchery building will take place in 1983.

Downstream trapping of juvenile migrants on McLoughlin Bay Creek to determine size and age and relative abundance will be initiated in 1983.

Contact: Maurice Boisvert, Project Coordinator, Special Projects Division.

Hartley Bay Band Project

A project manager was hired in July 1982 under the Local Employment Assistance Program (LEAP). This trainee attended fish culture courses offered by Malaspina College in Terrace and Nanaimo. He also worked with crews, hired under job creation programs to assess the enhancement opportunities around Hartley Bay located some 110 km south of Prince Rupert. Thirty-five thousand coho eggs from Hartley Bay Creek were incubated as a pilot project with the assistance of volunteers.

In 1983, assessment of enhancement potential will continue, and the construction of a small facility will commence.

This project provides employment in a remote native community. Initial fish production will improve the local food fishery. Expertise developed in this remote community will permit cost-effective enhancement to substantially benefit commercial fisheries.

Contact: Bruce Wright, Project Coordinator, Special Projects Division.

Snootli Creek Hatchery

Snootli Creek hatchery is located 15 km east of Bella Coola on the central coast. It is a Japanese-style chum hatchery with an expected capacity of 7.2 million reared fry by 1986. The hatchery was completed in 1979 and is currently on target for 1982 production with close to four million chum fry.

Approximately 3.4 million eggs were taken from four chum stocks of the Bella Coola system; namely Salloomt, Thorsen-Nuhaulk, Snootli, and Fish Creeks. Some 600,000 chum eggs were taken from the Necleetsconnay River, which flows into North Bentinck Arm about one-half km northwest of the Bella Coola River. Eggs were incubated separately and fry were reared separately and then released into their native streams. Returns from the 1979 and 1980 brood releases are expected to contribute approximately 40,000 adult chums to the 1983 escapement. These will be caught in the commercial and native food fisheries and will also supplement the brood stock available for hatchery egg-takes.

With the help of two COSEP students in 1982, all of the streams in the Bella Coola area were checked regularly for tagged fish. Three and four-year old chums from the 1978 and 1979 broods were sampled and enumerated. This sampling program will be continued in 1983 in order to assess fry-to-adult survival rates.

The chinook and coho programs initiated in 1981 were continued in 1982. Returns from the Atnarko River pilot hatchery make significant contributions to current runs, and encourage further hatchery production. Decreasing returns of Bella Coola River coho prompted hatchery production.

For the past two years, Snootli Creek hatchery has cooperated with the provincial Fish and Wildlife Branch in the Salloomt River steelhead fry-stocking program. Hatchery staff assist in collecting of brood stock, holding and care of adults at the hatchery, spawning, incubation of eggs, ponding and the release of fry. A small experimental group of steelhead has been reared at the hatchery for approximately two years to assess the practicality of producing hatchery smolts in a "cold water" facility. These steelhead were tagged in 1982, and they will be released into the Salloomt River in spring 1983.

New additions to the facility in 1982 included a walk-in freezer, and a storage shed for boats and trucks. Supplemental rearing and holding facilities for chinook, coho and steelhead were established. They consist of ten Capilano troughs and four tubs plumbed for both surface and groundwater. Two new groundwater wells were brought on line in 1982 to supplement the water supply available for rearing. The feasibility of net-pen rearing of chums in the Bella Coola estuary has been examined, and tentative plans to establish a pilot study are underway for 1984.

Contact: Russ Hilland, Stock Enhancement Officer, Enhancement Operations; Otto Rapp, Senior Project Engineer, Engineering.

Gardner Canal Reconnaissance

Beak Consultants Ltd. completed their report on the 1981 adult baseline surveys of the Kitlope, Tezwa, and Kowesas Rivers. These systems proved particularly difficult to work on, due to poor access and fluctuating flows. Complementary juvenile studies planned for the spring of 1982 were cancelled due to lack of funds.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations.

Kitimat Pilot Hatchery

The Kitimat River pilot hatchery projects are located approximately four kilometres upstream of the mouth of the Kitimat River.

Pilot I, consisting of four Capilano troughs, is located at the Eurocan pulp mill site, and has been in operation for five years. Annually this project has released from 50,000 to 150,000 groundwater reared chinook fry into the Kitimat River system.

In 1981, Pilot II, consisting of an additional eight Capilano troughs operated on well water, was constructed at the downstream end of the production hatchery which is currently under construction. This addition enabled fish production in 1982 to be increased to 271,500 fry, including 159,500 chinook, 30,000 chum, 55,000 coho, and 27,000 steelhead.

Kitimat pilot hatchery production is intended to increase the availability of donor stocks for the permanent hatchery facility. The pilot project has already made substantial contributions to the sport and commercial fisheries of the area in 1981 and 1982.

The production hatchery, which is scheduled to be completed in August 1983, will eventually produce 15 million salmonid fry, and enhance stocks of the Kitimat, Dala, Kildala and Bish Rivers. This facility will contribute to sport, commercial and native food fisheries of the North Coast.

Contact: Dave McNeil, Stock Enhancement Officer, Enhancement Operations.

Kitimat Production Hatchery

This new major production facility, to be operational in the fall of 1983, is located three kilometres south of Kitimat and 300 m downriver of the Eurocan pulp mill water intake. One of the most complex facilities to be constructed, Kitimat hatchery is designed to enhance nine chum stocks, seven chinook stocks and four coho stocks within the Kitimat River system and Kitimat Arm (Kildala and Dala Rivers and Bish Creek). Sockeye and pink salmon and steelhead trout will also be enhanced.

Each stock will be kept separate within the hatchery and returned to donor streams for imprinting and release.

A variety of hatchery techniques will be used in this facility:

- for chum, modified Atkins incubation to the eyed stage, Japanese keeper channels to hatch, Japanese rearing channels to release
- for chinook, coho and steelhead, Heath tray incubation, Capilano rearing troughs for initial rearing, and raceways for final rearing
- for sockeye and pink salmon, Pallant box incubation, then release.

Total production goals are:

- 11 million chum eggs, 158,400 total adult production
- 3 million chinook eggs, 64,500 total adult production
- 592,000 coho eggs, 60,000 total adult production
- 55,000 steelhead eggs, 1,000 total adult production
- 500,000 pink eggs, 10,000 total adult production
- 500,000 sockeye eggs, 4,000 total adult production.

The diversity of stocks and species requires a complicated system of water supply. The hatchery design includes capability to deliver river or well water or both, unheated or heated, filtered or raw, aerated or unaerated, as required on demand. A complicated system of piping and holding tanks in the aeration tower provides for this facet of operations.

A five-year agreement with the adjacent Eurocan pulp mill will provide an unlimited supply of waste hot water which will be used to adjust the temperature of river water. This allows the release of fish of optimal size during the natural smolt migration periods. There is no direct mixing of the two water supplies; rather, heat is transferred by the circulation of each water supply through coils in a heat exchanger unit.

This waste hot water will also be used to heat the hatchery building and to keep the river water intake structure free of ice buildup during winter months.

The provision and use of this waste hot water is an energy-saving feature. The cost is far below the estimated capital cost and projected operational costs of heating by other conventional means.

A contract for interior completion of the building (offices, laboratories, incubation room slabs, chum ponds, intermediate rearing areas, water supply piping and drainage) was tendered in late 1981 and construction completed between February and July 1982.

It is of note that all the chum rearing channels and intermediate rearing troughs in this facility are inside the building because of the extreme winter conditions in this part of the province.

In early 1982, small contracts were issued and completed for miscellaneous metalwork to be installed in the building, such as aluminum rearing troughs, Atkins boxes, Heath tray stands, and Pallant boxes. In-house design work was carried out from November/December 1981 to May 1982 for the river intake structure, concrete rearing ponds and piping, and fishway.

Consultants designed a warm water recovery facility at the Eurocan mill, a supply pipeline for the hot water from the Eurocan mill to the hatchery and an aeration tower structure for treating and distributing process water to the hatchery and ponds.

The contract for intake ponds and the fishway was awarded in July, and by year-end, 60 percent had been completed. Work was hampered early in construction by a lockout/strike in the industry and this affected scheduled completion dates. However, mild winter conditions in 1982/83 allowed construction to progress unimpeded so that completion in late April or early May 1983 is expected.

The contract for the warm water supply line was successfully completed during August and September and is in place ready for hookup at both the Eurocan mill and hatchery ends as soon as the connecting contract is complete. This contract involved the installation of about 1.6 km of fibreglass reinforced pipe (FRP) from inside the mill site, crossing under the CN rail tracks and the main highway to the

Alcan plant, en route to the hatchery. The use of FRP pipe is innovative for hatchery work and was selected for its optimum thermal properties in conducting the heated water underground to the hatchery.

An agreement was negotiated, drawn up and signed between the Department of Fisheries and Oceans and Eurocan for the purchase of a supply of waste hot water from the plant operations.

Through joint cooperation and coordination with Eurocan's own engineers and consultants, design work for tapping pipes into their hot water and steam lines, erecting a hot water storage tank, building, pump control panel and supply line was completed. These components will be located within the mill's operating plant. The contract for this work was awarded in November 1982, and is scheduled for completion in April 1983. This contract will link up with the FRP pipeline installation. The last major contract to be tendered on the project was for the aeration tower.

The facility is expected to be in an operational state for full-scale production by the fall of 1983.

Due to the complexity of the design and operational capability of the facility, it is expected that a considerable "running-in" period will be required when construction is complete and start-up made. There will be some construction and design "bugs" to eliminate for smooth and efficient operation.

Considerable savings were realized after the original consultant design for the hatchery was rejected and the Department developed a design utilizing a preengineered fabricated building. As a result, it is anticipated that the project will be built within the budget allocated.

Contact: Ian Ross, Project Engineer,
Engineering.

Kitimat Arm Reconnaissance

Aquatic Resources Ltd. completed their reports on 1981 juvenile salmonid utilization of the Kitimat, Kildala, Dala, and Bish River estuaries.

Contact: Bruce Shepherd, New Projects
Coordinator, Enhancement
Operations.

Central Coast Tagging Report

During 1976, 1978 and 1979, tagging studies were undertaken to aid in management of the Central Coast salmon stocks. In 1978 and 1979, these studies were funded by SEP's Program Development Branch. Preliminary analysis of these studies was conducted by management biologists but in 1982, a formal analysis was conducted. The report detailing this work showed that:

- sockeye in the Central Coast area consist of a wide variety of stocks throughout the fishing season. Movement is inward through Seaforth Channel and southward along the coast to Fitz Hugh Sound and Rivers Inlet. There was some evidence in 1978 to indicate that northward-bound sockeye predominate in the area in early July and southward-bound stocks are more abundant in early August
- chinook tagging was limited during the studies, but the general trend was one of southward movement of stocks through the coastal waters. As well, some fish seemed to take an alternate route through the inner channels. Fish in the area included stocks from the Kitimat area south to the Columbia River in the U.S.
- coho migrate inward to the inner channels and fresh water in Area 6. Southbound stocks moved through Laredo Channel from late July to mid-August. Coho tagging in Area 7 indicated an inward and southward movement to Fisher Channel and Rivers Inlet. Milbanke Sound tagging studies showed a mingling of many different coho stocks
- outer waters of Area 6 are a major migratory path for chum stocks. North-

bound stocks were most abundant in early July, while southbound stocks were more numerous from mid-July to mid-August. Area 7 tagging showed a predominance of northward-migrating chum in early July. This was followed by a period when local stocks predominated on their inward migration to fresh water. Some Area 8 chums were also present, migrating via Return and Johnston Channels

- In Area 6, pink stocks were very mixed from late July to early August. Northbound pinks move through Area 6 from late June to mid-July. Local stocks dominate from mid-August to September. Area 7 tagging studies showed that pinks were northbound from late June to mid-July. Local stocks increase in numbers as the year advances. Most of the southbound fish found in the area were heading for the Bella Coola-Dean Channel areas.

Contact: Dave Peacock, Management Biologist, Field Services Branch, Prince Rupert.

Provincial Status Report

Fry Stocking Assessment of the Upper Salloomt River

A major falls, on the Salloomt River 4.5 km upstream from its confluence with the Bella Coola River, prevents anadromous fish passage to the upper Salloomt (354,000 m^2 rearing area). Above this barrier, only Dolly Varden char are present; below the barrier, the stream is utilized by anadromous salmonids, particularly steelhead and coho. Prior to barrier removal, a detailed biophysical assessment was performed to determine probable benefit/costs. The Salloomt River reconnaissance study identified the potential steelhead smolt yield at carrying capacity as 8,500 fish, to give an adult return of 680 to 1,020 fish. Maintaining wild production at 8,500 smolts creates a harvestable surplus of 500 to 960 steelhead adults. The potential coho smolt yield was estimated at 75,000 smolts for additional adult returns of 5,000 fish. The objectives of the 1981 work were to determine whether early (unfed) and late (fed) steelhead fry will survive and occupy headwater stream habitat in the densities predicted by the study, and to determine which fry group survived best when released into a "wild" rearing environment.

Some 28,800 unfed fry, averaging 0.39 g in weight, were released on August 16 with a second release of 20,200 unfed fry (0.32 g) on September 16. The juvenile census was conducted in September at 10 index sites by using standard electroshocking. Larger steelhead juveniles were collected using baited Gee traps. Twelve traps were distributed in more complex habitat that could not be easily electrofished. All steelhead juveniles larger than 60 mm were sacrificed and examined at Snootli Creek hatchery for dye marks under ideal lab conditions.

Juvenile steelhead captures were made more efficient in 1982 by the warmer stream temperatures (9-11°C), good light conditions and clear water, and relatively low discharge. Despite the September flood, reasonably good fry and yearling densities were measured in shallow, low velocity sites. Fry densities ranged from 0.06 - 0.57 fish/m^2, and yearling densities ranged from 0.01 - 0.24 fish/m^2.

Total catch of resident Dolly Varden was 381, with 155 fish ranging from 100 to 212 mm in length caught with baited Gee traps. Only 4 percent of the steelhead yearlings were caught by Gee traps; however, the largest fish were caught by this method. It appears the unfed fry of the 1981 release (78,200 fry) survived better than the later releases of fed fry. The earliest release of unfed fry represented 77 percent of the yearling captures, but only 50 percent of the total fry release. The larger fed fry (1.4 g, 49 mm) released in October fared better than the smaller fed fry (0.8 g, 42 mm) released the same day. The larger fed fry represented 17 percent of the total release, but comprised 15 percent of the recaptured yearlings. The smaller fed fry represented 33 percent of the total release but comprised only 8 percent of the recaptures.

Early September census of steelhead juveniles without further flood influences should provide further clues of maximum fry capacity. Results to date will be used to modify this pilot project accordingly so that maximum benefits can be realized.

Contact: Ron Ptolemy, Fisheries
Biologist, Fish Habitat
Improvement Section, Fish and
Wildlife Branch, Victoria.

Atnarko/Bella Coola Steelhead Enhancement--Salloomt River Fry Stocking

During the 1970s, returns of steelhead to the Bella Coola system declined considerably, due mainly to overharvesting by the sport and native food fisheries, as well as habitat degradation. Starting in 1981, several enhancement projects were undertaken on the system to increase steelhead production and thereby restore the fisheries to former levels of abundance.

The primary steelhead enhancement project on the Bella Coola system involves a six-year headwater stocking program on the Salloomt River. The objective of this program is to establish steelhead in previously unused rearing habitat above a series of impassable falls. This barrier will eventually be removed to allow the population to become self-perpetuating.

In order to produce additional steelhead to the upper system, a program was initiated in 1982 to release fry into Hotnarko Lake (Atnarko drainage). Surveys of the lake had indicated that it was barren of fish, yet well suited for good fish production. It is expected, however, that only a small portion of the steelhead fry will become smolts and migrate to the ocean. However, the fish that remain in the lake will provide a self-sustaining trout fishery. Brood stock collection, incubation and rearing of fry were carried out in conjunction with the Salloomt River project.

In 1982, the second steelhead fry release of the six-year program was carried out on the Salloomt River. Brood stock was obtained from the Bella Coola River during November to June. Adult holding, incubation and preliminary rearing were carried out at Snootli Creek hatchery. In late September, the survival and growth of fry released in the Salloomt River were assessed.

In June 1982, Camera Channel was surveyed to enumerate steelhead spawners and to determine the extent of use of the spawning platforms. A follow-up redd count was carried out in August.

During April to July 1982, a total of 103,000 eggs were taken from Bella Coola River brood stock; 82,000 and 21,000 eggs from early winter and spring-run adults, respectively. Approximately 49,000 fry averaging 0.4 g in weight were released into the Salloomt River between mid-August and mid-September. In addition, 24,000 steelhead fry (0.2 g) were released into Hotnarko Lake on September 10. The expected return of adults in 1987 from 1982 fry stocking is 600 to 1,000 fish.

On June 27, 1982 approximately 150 adult steelhead were enumerated in Camera Channel with over 50 percent of the spawners observed on the introduced gravel platforms. In mid-August, 178 redds were counted, of which 56 percent were on the new spawning platforms. Spring freshets eroded several of the platforms, although 80 percent of the introduced gravel was still usable. Pink and coho adults have also utilized the gravel to some extent.

Contact: Jack Leggett, Fisheries
Biologist, Fish and Wildlife
Branch, Williams Lake.

Kitimat River Steelhead Stocking

The Kitimat River is located approximately 30 km due south of Terrace, and bisects the City of Kitimat near the head of Douglas Channel. The river and its tributaries drain a wide glaciated valley of some 214,600 hectares.

Historically, the Kitimat River supported an above-average winter steelhead run, which dwindled over the years, due to the combined effects of habitat degradation and overfishing. With construction of a new hatchery in Kitimat, the opportunity arose to bolster Kitimat steelhead stocks; basically to align them with angler demand and perhaps to reduce some of the fishing pressure on other Skeena River steelhead stocks. Hatchery steelhead were to be reared to smolt size and then released as far upstream as possible. However, it became necessary to review plans when it became apparent that the new hatchery would not be ready in time for 1982 steelhead production. Therefore, the 1982 project was redesigned and scaled down to pilot status so that any problems inherent in Kitimat steelhead production could be ironed out by hatchery staff.

Six winter-run female steelhead were stripped of 31,000 eggs which produced 27,000 fry. In October 1982, 26,500 fry were released over 20 km of Chist Creek to the rough criteria of two fry per metre of habitat. Just prior to release, the fry were marked with a fin clip.

Twenty-five thousand steelhead smolts will be reared annually in Kitimat hatchery for release into the upper Kitimat River mainstem. Once the Kitimat hatchery comes on line, creel surveys will be performed from time to time to determine what portion of the anglers' catch are fish of hatchery origin.

Contact: Bill Chudyk, Fisheries
Biologist, Fish and Wildlife
Branch, Smithers.

Job Creation Projects

Hartley Bay Project

Five residents of this isolated community modified the existing volunteer incubation box and conducted bioreconnaissance work on several rivers and streams.

Some 35,000 coho eggs were taken in 1982, with 1,000 eggs designated for the school incubation box. The remaining eggs provided valuable fish culture experience for the new Community Economic Development Program employees. The construction of a small hatchery facility in Hartley Bay has also started.

Contact: Rob Brouwer, Project
Developer, Job Creation Unit,
Special Projects Division.

Oweekeno Salmon Enhancement Program

In September, the Owikeeno Nation initiated a joint venture between DFO, Indian and Northern Affairs Canada and the B.C. Ministry of Forests. This project involved cleaning logging debris from sockeye spawning beaches in Owikeno Lake, but this work was dropped due to a lack of commitment from the forest industry and the Ministry of Forests.

The project is currently devoted to the construction and operation of a floating incubator containing approximately 20,000 sockeye eggs. This new concept in incubator design is based on using ambient river water for incubation. Egg survival is over 90 percent. More development work is planned for 1983.

Bella Coola Project

The Nuxalk Band in Bella Coola is working in conjunction with Snootli Creek hatchery. This hatchery was built by DFO and is maintained as a major chum hatchery as well as an important center for training and technical expertise in the central coast. Band members are constructing auxiliary hatchery facilities to allow greater diversification into coho, steelhead and chinook enhancement.

Bella Bella Project

The Heiltsuk Band in Bella Bella has operated a small hatchery under the Community Economic Development Program since 1977. A job creation project was used to augment hatchery activities by undertaking the construction of a flow control weir at McLoughlin Bay Creek, which will provide greater water storage to allow the rearing of coho.

Klemtu Project

The Kitasoo Band in Klemtu has undertaken reconnaissance studies of salmon streams in the vicinity in order to build an information base for future enhancement. LEAP, the Community Economic Development Program and job creation have joined forces in planning a small chum and coho hatchery as well as a potential sockeye spawning channel. This spring, the crew will undertake to sample chum, coho and sockeye to get an estimate of numbers, timing and quality of the juveniles.

Contact: Judy Barnetson, Project
Developer, Job Creation Unit,
Special Projects Division.

Table 26

Public Participation Projects

CENTRAL COAST PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1982	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1982 Releases
Klemtu Creek	Kitasoo Indian Band	25	3	incubation, incubation in school	pink chum	— 2,000	— 10	— 16
Hartley Bay Creek	Hartley Bay School	60	5	incubation in school	coho	200	50	4
Dona River	Dona River Community Association	25	2	incubation, construction	coho	Did not operate til. 82/83.		

Contact: Barry Peters, SEP Community Advisor.

Table 27

Central Coast SEP Facilities: Juvenile Releases 1982*

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size(g)
Bella Bella Hatchery						
Chum	1981	McLoughlin Bay	525,504	0	52	1.0
Snootli Creek Hatchery						
Coho	1981	Bella Coola R.	56,600	28.4	81.6	1.4
Chinook	1981	Atnarko R.	74,596	97.2	71.7	2
Chinook	1981	Noosgulch R.	5,100	0	71.7	2
Chinook	1981	Salloomt R.	15,000	0	71.7	2
Chum	1981	Salloomt R.	584,205	16.9	84.0	0.71
Chum	1981	Snootli/ Thorsen Cr.	620,667	0	86.7	0.81
Chum	1981	Fish Cr.	486,459	14.2	93.5	0.73
Chum	1981	Neeleetsconnay R.	441,645	11.3	83.5	0.74
Steelhead	1981	Bella Coola R.	73,100	0	76.4	0.35
Kitimat Pilot Hatchery						
Coho	1981	Kitimat R.	55,000	0	93.4	1.58
Chinook	1981	pilot I	60,500	40	85.4	6.5
Chinook	1981	pilot II	78,400	13	79.3	4.4
Chinook	1981	Hirsch Cr.	20,500	100	75.3	5.4
Chum	1981	Kitimat R.	30,000	0	60.5	2.65
Steelhead	1982	Kitimat R.	26,700	100	76.3	1.58

*Includes facilities constructed prior to SEP.

Table 28

Central Coast SEP Facilities*: Status at December 1982

Species	Stock	Brood	Stage	No. on Hand	Expected Release		
					Date	Number	Site
Bella Bella Hatchery							
Chum	Neekas Cr.	82	egg/ alevin	700,000	May 1983	650,000	McLoughlin Bay
Hartley Bay Band Project							
Coho	Hartley Cr.	82	egg	33,000	July 1983	30,000	Hartley Cr.
Snootli Creek Hatchery							
Coho	Bella Coola R.	82	alevin	88,000	N/A	76,000	N/A
Chinook	Atnarko R.	82	fry	235,150	June 1983	185,300	N/A
Chum	Salloomt R.	82	fry	1,586,000	March 1983	1,561,000	Salloomt R.
Chum	Thorsen Cr.	82	fry	771,000	March 1983	742,500	Thorsen Cr.
Chum	Snootli Cr.	82	fry	775,000	March 1983	769,000	Snootli Cr.
Chum	Fish Cr.	82	fry	47,000	March 1983	46,300	Fish Cr.
Chum	Neeleetscon-noy R.	82	fry	686,000	March 1983	677,500	Neeleetscon-noy R.
Steelhead	Atnarko R.	81	presmolt	7,500	June 1983	7,500	Salloomt R.
Steelhead	Atnarko R.	--	adult	26[1]	--	--	Salloomt R.
Kitimat Pilot Hatchery							
Chinook	Kitimat/ Hirsch	82	fry	290,000	May 1983	240,000 50,000	Kitimat R. Hirsch Cr.

*Includes facilities constructed prior to SEP.

N/A means "not available."

[1] Brood stock which should produce 100,000 fry for release in August 1983.

Table 29

Central Coast SEP Facilities: Surplus Sales 1982*

Species	Amount of Fish (kg)	Eggs (number)	Native Food Fish (pieces)	Value ($)
Snootli Creek Hatchery				
Coho	0	10,000	0	--[1]

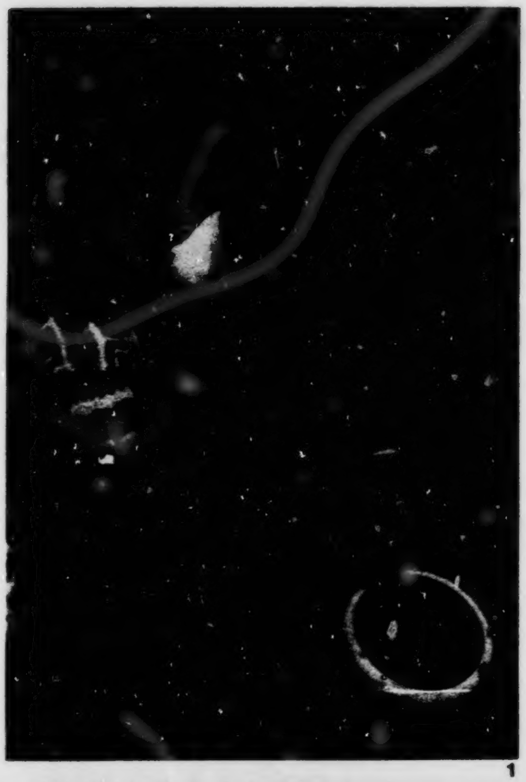
*Includes facilities constructed prior to SEP.
[1] No payment received; provided for research purposes.

Table 30

Central Coast SEP Facilities: Adult Production*

	Expected Production from 1982 Releases			At Full Production	
Species	Total Adult Production	Years of Return	Contribution to Fisheries	Total Adult Production	Contribution to Fisheries
Bella Bella Hatchery					
Coho	--	--	--	1,800	1,269
Chum	8,408	1984-1986	5,826	33,700	23,333
Sockeye	--	--	--	400	156
Snootli Creek Hatchery					
Coho	849	1984-1985	630	4,000	2,820
Chinook	710	1984-1987	318	10,000	4,485
Chum	42,659	1984-1986	29,861	130,000	90,090
Steelhead	468	1984-1988	234	600	300
Kitimat Pilot Hatchery					
Coho	810	1984-1985	486	60,000	36,000
Chinook	4,785	1983-1987	2,799	64,500	37,732
Chum	607	1984-1986	424	158,400	118,800
Steelhead	256	1984-1988	128	1,000	500
Kitimat Production Hatchery					
Coho	--	--	--	60,000	36,000
Chinook	--	--	--	64,500	37,732
Chum	--	--	--	158,400	118,800
Pink	--	--	--	10,000	6,000
Steelhead	--	--	--	1,000	500

*Includes facilities constructed prior to SEP.



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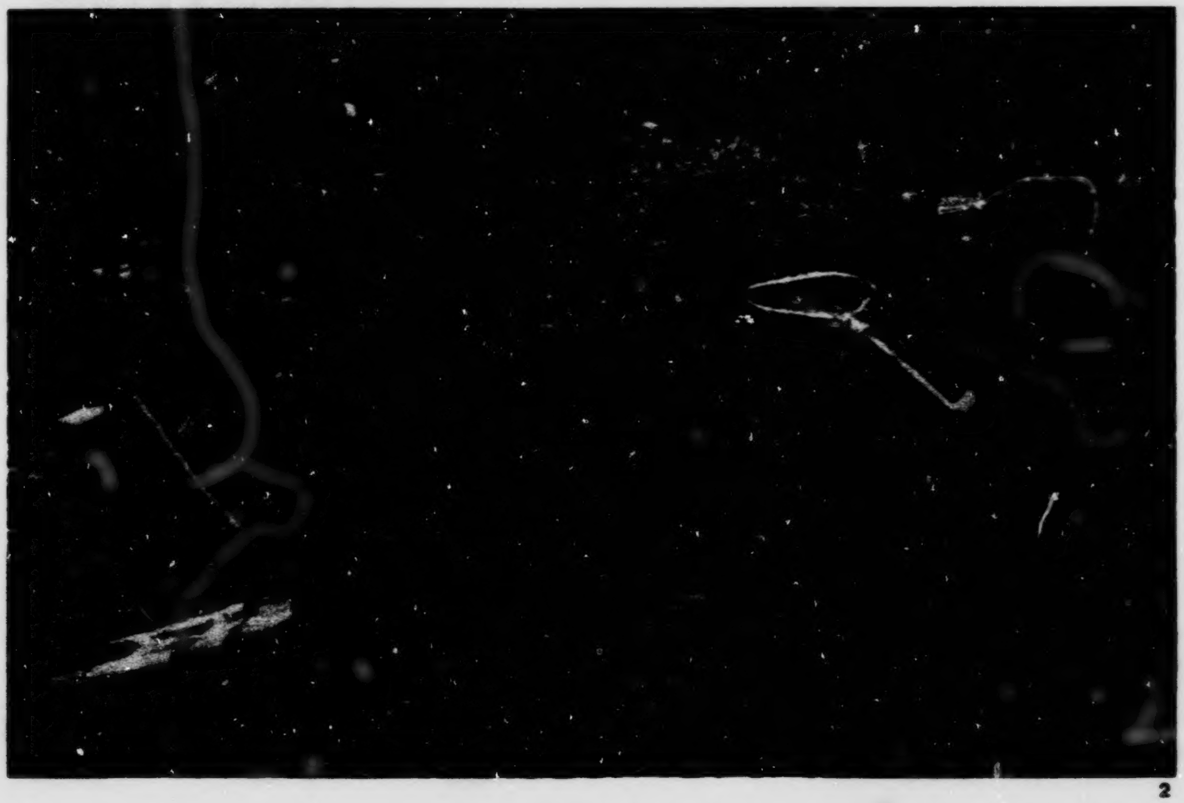
1. *Volunteers improvise for projects in remote locations. Note the washing machine tub in foreground.*
2. *Port Clements job creation crew used an electroshocker for brood stock collection for a volunteer incubation box project.*



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Queen Charlotte Islands

Pallant Creek Hatchery

Pallant Creek hatchery is located 48 km south of Sandspit. It is a modified Japanese-style chum facility with a capacity of 10 million eggs. The hatchery was constructed in 1978.

Chum, coho, and steelhead trout are incubated and reared at the facility. Chum salmon are reared in sea pens and then released, whereas coho and steelhead are reared at the hatchery in fresh water for about one year and then are released. Coded-wire tagging of chum was carried out in 1982 with great success.

Contact: Pat Slobodzian, Stock
Enhancement Officer,
Enhancement Operations.

Mathers Creek Pilot Hatchery

Mathers Creek hatchery is located 10 km east of Beattie Anchorage on Louise Island and is designed to enhance pink, chum, and coho salmon in Cumshewa Inlet. Initial construction was started in 1980. Eggs are incubated in Heath trays and upwelling gravel boxes and the fry are reared in "aquabreeders" until their release. Results have shown that nearby groundwater is of poor quality. Egg incubation and fry rearing now takes place in a mixture of groundwater and surface water.

Contact: Pat Slobodzian, Stock
Enhancement Officer,
Enhancement Operations.

Cumshewa Inlet Chum Tagging Report

During 1980 and 1981, SEP's Program Development Branch funded chum salmon tagging and recovery programs in Cumshewa Inlet and surrounding waters. These studies were designed to aid in the management of chum salmon returning to Pallant Creek and Mathers Creek facilities. The Cumshewa Inlet report was funded to examine the results of these tagging studies and compare them to earlier studies conducted on the Queen Charlotte Islands.

The report showed that:

- most chum returning to Cumshewa Inlet appear to immigrate directly west from Hecate Strait; this contradicted earlier concepts of migration through Skidegate Channel or along the east coast of the Islands
- peak abundance of chum stocks in Cumshewa Inlet occurred in late September in the area between Chadsey Creek, Pinical Point, Renner Point and Oliver Island
- most chum appeared to hold in the Inlet for three weeks before heading upstream
- there is little fish movement between Cumshewa and Selwyn Inlets; Cumshewa Inlet is mainly a terminal area little used by transient stocks
- unenhanced stocks within Cumshewa Inlet returned at the same time as those returning to Pallant Creek
- commercial fisheries could be established in either the Renner Point area or the area between Nedden Island, Chadsey Creek and Pinical Point
- seine boat test fishery was recommended to help provide escapement data similar to that obtained for the Skeena and Fraser fisheries.

Contact: Lynda Orman, Queen Charlotte
Island Biologist, Field
Services Branch.

Skidegate Community Development Program

The Skidegate Band Council on the Queen Charlotte Islands, hired a project manager trainee under the local Employment Assistance Program (LEAP), beginning in July of 1982. The trainee attended various fish culture courses offered under the Community Economic Development program (CEDP), worked at other SEP projects and conducted bio-reconnaissance, stream work and a small incubation project in conjunction with a job creation crew. The bio-reconnaissance work is intended to contribute to a study of the feasibility of establishing a small facility in the Skidegate area.

Contact: Bruce Wright, Project
Coordinator, Special Projects
Division.

Masset Community Development Project

The Masset Indian Band, on the Queen Charlotte Islands, under contract with SEP, undertakes enhancement work on chinook, coho and sockeye stocks in the Yakoun River watershed. In 1982, they collected brood stock and incubated 309,000 Yakoun River chinook eggs in an upwelling gravel box on King Creek, 55,000 Gold Creek sockeye eggs in a box on Gold Creek and approximately 50,000 coho eggs from each of King, Wilson, and Gold Creeks, also in incubation boxes.

Rearing, conducted in net pens on Marie Lake, was successful. Owing to the limited success of incubation, however, the number of fry reared was small. Some 25,000 tagged chinook were released back into the Yakoun River in July at a weight of three grams, and an additional 42,000 were released in September at a weight of five grams.

As a result of the relatively low survival rates to date, it was decided to change incubation strategies for this project from upwelling incubation boxes to Heath trays. This is also intended to reduce the costs of monitoring these remote boxes. To house the new type of incubation system, a new hatchery building is being constructed in the long house style under a job creation program.

This project provides full-time employment for eight members of the Masset Band and also provides them access to training programs and opportunities for skill development.

Contact: Bruce Wright, Project
Coordinator, Special Projects
Division.

Provincial Status Report

Pallant Creek Steelhead

Pallant Creek flows into Cumshewa Inlet, located off the east coast of Moresby Island in the Queen Charlotte Islands.

A winter steelhead pilot project was implemented in 1982 to test the existing hatchery water supply, its temperatures and egg and fry survival. Steelhead fry produced would be released in upper Pallant Creek above an impassable barrier. Since present angler demand does not exceed existing harvestable steelhead stock levels, there is no need for large-scale enhancement. However, should future angler demands increase beyond supply, the potential at Pallant Creek hatchery does exist to produce more steelhead for stocking above the barrier.

Some 10,000 steelhead eggs were taken in 1982 from three female winter steelhead. About 4,000 were killed due to a water hardness problem. In July, 4,070 steelhead fry, weighing an average of 1.75 g, were released into upper Pallant and Crystal Creeks above the falls. All released fry were marked for later identification as adults.

Enhancement on upper Pallant Creek will continue on a pilot scale in hopes of establishing a run of winter steelhead above the falls and of meeting future increased angler demand.

Traps and electroshocking will be used periodically to determine the condition of upper Pallant Creek juvenile steelhead.

Contact: Bill Chudyk, Fisheries
Biologist, Fish and Wildlife
Branch, Smithers.

Yakoun River Steelhead

The Yakoun River drains Yakoun Lake and flows north/northwest into Masset Inlet near the village of Port Clements, on Graham Island.

The Yakoun River, well-known among steelheaders as a river in which winter steelhead abound, needed important fisheries management questions resolved. In particular:

- do larger early-run (September 15 to November 15) steelhead spawn in different parts of the Yakoun River from smaller later-run fish?
- what are the life histories of both runs of steelhead trout?
- what are the population estimates for both early- and late-run steelhead trout?
- how do steelhead movements relate to water flows and temperature?
- what is the importance of Yakoun River tributaries to overall steelhead production and spawning?

To answer these questions, the Port Clements Rod and Gun Club, Queen Charlotte Chapter of the Steelhead Society of British Columbia and Fish and Wildlife staff marked and recaptured adult steelhead from September 15, 1981 to May 1982.

Of 200 steelhead tagged and released, it was impossible to detect any significant differences in size or preference for a particular segment of the Yakoun River. Eight distinct age classes were isolated for Yakoun River maiden-run fish, as well as three repeat spawning age classes. Steelhead that spent two or three years in salt water comprised 84 percent of the Yakoun River population. One startling discovery was the low incidence of repeat spawners in the Yakoun River.

A reasonable estimate of Yakoun River steelhead population would be 2,000 fish based on the tagging program. Steelhead movements relative to water flows and temperature and utilization of tributaries have not yet been resolved.

The 1982-1983 sequel to this project has already placed 300 tags on Yakoun River steelhead. In addition, some work is now being done on tributary streams of the Yakoun River.

Contact: Bill Chudyk, Fisheries
Biologist, Fish and Wildlife
Branch, Smithers.

Job Creation Projects

Pallant Creek Hatchery Project

Three people were employed to help blast Pallant Creek falls to allow salmonids access to underutilized habitat above these falls. The crew also assisted Pallant Creek hatchery with coho and chum brood stock collections.

Skidegate Band Enhancement Project

The Skidegate Band Council sponsored a salmonid enhancement project and hired eight people. The Skidegate Band wanted to increase local employment and promote awareness of the salmonid resource among its people. The Band also wanted to increase coho returns to Slarkedus Creek, and ultimately, to enhance sockeye runs to the Copper River, where they have had a traditional food fishery for many years.

The Skidegate crew established a 50,000-egg incubation box on Slarkedus Creek and stocked it with 22,000 coho eggs. By year-end, the survival rate was about 90 percent. The crew also conducted coho enumeration, habitat inventories and stream profiles on Slarkedus and Mission Creeks. Work completed in the Copper River watershed included a survey on Skidegate Lake, physical monitoring of six streams and hatchery site reconnaissance.

Port Clements Project

The Port Clements Project was sponsored by the Port Clements Rod and Gun Club. The Club wanted to increase local employment and to provide training in enhancement techniques in their village.

The Port Clements crew built a 50,000-egg incubation box and a large box for holding adults and rearing fry. These facilities were placed on a small tributary of the Mamin River called One Mile Creek, near Juskatla. A total of 29,000 coho eggs were taken from brood stock in the Mamin River. The Port Clements crew also cut a seven km trail along a tributary of the Yakoun River called Canoe Creek at the request of the local fishery officers. Crew members also built a small classroom incubation box for the local school and stocked it with coho eggs obtained from their One Mile Creek incubation box. Fry from this box will be released into upper sections of One Mile Creek and other tributaries of the Mamin River. The Rod and Gun Club hopes to use knowledge and experience gained in 1982 to increase their salmon production for next year's volunteer project.

Masset Salmonid Enhancement Project

The Masset Band Council employed seven people to assist the existing Community Economic Development Program located on King Creek, a tributary of the Yakoun River.

The crew helped collect 300,000 chinook, 150,000 coho and 50,000 sockeye eggs from the Yakoun River and its tributaries. The numbers, distribution and timing of Yakoun Lake sockeye and Phantom Creek coho were also determined.

In addition, the crew cut an access trail along Florence Creek to enable fishery officers to enumerate spawners and assisted a heavy metal study in the Florence Creek watershed.

Northern Trollers Association - Masset

Seven residents of Masset obtained 18,000 coho eggs for incubation in their Deep Creek box and 22,000 coho eggs for their Nadu Creek box. This group was previously active in a volunteer project, but the Employment Bridging Assistance Program (EBAP) enabled them to purchase Heath trays for additional incubation and a rearing trough to rear the coho to smolt size.

Contact: Rob Brouwer, Project
Developer, Job Creation Unit,
Special Projects Division.

Table 31

Public Participation Projects

QUEEN CHARLOTTE ISLANDS PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1982	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1982 Releases
Charley Hardy Cr.	UFAWU Local 28	6	1	stream improvement, construction	chum	No eggs taken in 1981.		
Powrivco River	Frank Beban Logging	20	3	incubation, incubation in school	chum	25,600	80	205
					coho	8,000	67	96
Sewell Inlet	Western Forest Products	27	2	incubation	pink	—	—	—
					chum	25,000	74	200
					coho	—	—	—
Fairfax Creek	Tasu School	25	4	incubation, incubation in school	coho	180	90	2
Fairfax Creek	Tasu Lions Club	6	5	incubation	coho	40,000	69	480
Gore Brook	Gore Brook Group	6	4	incubation	coho	12,000	46	144
					chum	9,500	59	76
Gore Brook	Queen Charlotte City School	40	1	incubation in school, construction	coho	—	—	—
One Mile Creek/ Rennie Creek	Port Clements Elementary School	6	1	incubation in school, stream improvement, construction	coho	No eggs taken in 1981.		
Yakoun River/ Rennie Creek	Port Clements Rod & Gun Club	50	2	studies, incubation, construction	coho	No eggs taken in 1981.		
					steelhead	—	—	—
Tultey Creek/ Millard Creek	Tahayghen Elementary School	3	3	incubation in school	coho	No eggs taken in 1981.		
Nadu Creek	Northern Trollers Assn.	12	4	incubation	coho	17,000	61	204
Wylie Creek/ Masset Area Creeks	G.M. Dawson Salmon Enhancement Club	30	3	studies	coho	No eggs taken in 1981.		
Deep Creek	Yogied Enhancement Club, Northern Trollers Assn., Don Young	8	2	incubation	coho	3,000	60	36

Contact: Gary Taccogna, SEP Community Advisor

Table 32

Queen Charlotte Islands SEP Facilities*: Juvenile Releases 1982

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size(g)
Pallant Creek Hatchery						
Coho	1981	production	192,841	16	86	3.96
Chum	1981	production	7,249,190	0.84	85	1.56
Steelhead	1982	production	5,128	81	50	1.41
Mathers Creek Pilot Hatchery						
Chum	1981	Mathers Cr.	512,246	N/A	80	0.7-2.32
Masset Community Development Project						
Coho	1980	King Cr.	3,100	0	61	0.5
Coho	1981	Gold Cr.	2,000	0	4	3
Chinook	1981	Yakoun R.	67,000	75	46	3-5
Sockeye	1981	Gold Cr.	1,000	0	3	0.25

*Includes facilities constructed prior to SEP.
N/A means "not available."

Table 33

Queen Charlotte Islands SEP Facilities*: Status at December 1982

Species	Stock	Brood	Stage	No. on Hand	Expected Release Date	Expected Release Number	Expected Release Site
Pallant Creek Hatchery							
Coho	Pallant Cr.	82	alevin	435,200	June 1983	420,000	Pallant Cr.
Chum	Pallant Cr.	82	alevin	4,610,800	May 1983	4,000,000	Deer Bay
Mathers Creek Pilot Hatchery							
Coho	Mathers Cr.	82	egg	65,000	June 1983	62,700	Mathers Cr.
Chum	Mathers Cr.	82	egg	240,000	May 1983	204,000	Mathers Cr.
Masset Community Development Project							
Coho	Wilson Cr.	82	egg	50,000	Aug. 1983	45,000	Yakoun R./ Wilson Cr.
Coho	Gold Cr.	82	egg	35,000	Aug. 1983	32,000	Gold Cr.
Coho	King Cr.	82	egg	45,000	Aug. 1983	40,000	King Cr.
Chinook	Yakoun R.	82	egg	230,000	Aug. 1983	215,000	Yakoun R.
Sockeye	Gold Cr.	82	egg	11,000	March 1983	10,000	Marie Lake

*Includes facilities constructed prior to SEP.

Table 34

Queen Charlotte Islands SEP Facilities: Escapement to Facility 1982*

Species	Escapement to Facility	Spawned for Hatchery Stock		% Marked male and female
		male	female	
Pallant Creek Hatchery				
Coho	2,778	161	180	10
Chum	6,000	1,764	1,850	1
Pink	10,283	N/A	N/A	N/A
Mathers Creek Pilot Hatchery				
Coho	4,208	25	26	N/A
Chum	638	84	134	N/A
Pink	20,235	N/A	N/A	N/A

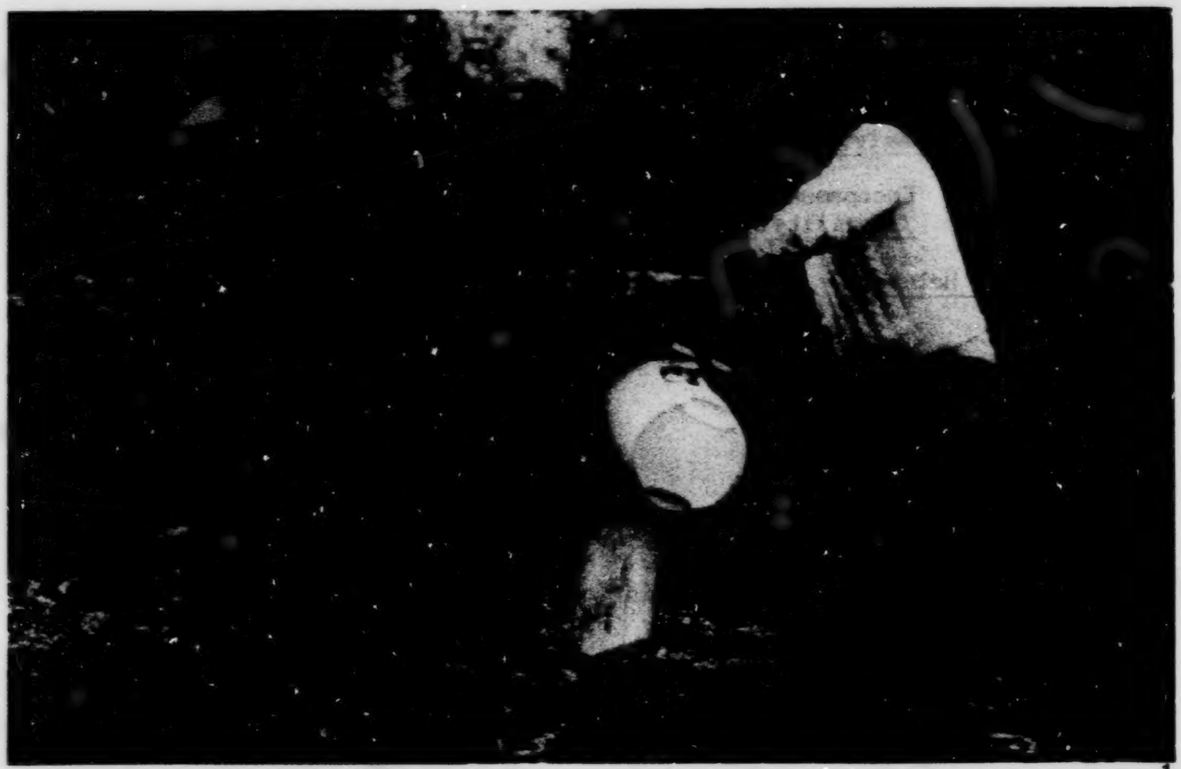
*Includes facilities constructed prior to SEP.
N/A means "not available."

Table 35

Queen Charlotte Islands SEP Facilities: Adult Production*

Species	Expected Production from 1982 Releases			At Full Production	
	Total Adult Production	Years of Return	Contribution to Fisheries	Total Adult Production	Contribution to Fisheries
Pallant Creek Hatchery					
Coho	2,893	1983-1985	1,296	3,200	1,434
Chum	180,185	1984-1986	78,488	144,000	62,726
Steelhead	51	1984-1988	28	N/A	N/A
Mathers Creek Pilot Hatchery					
Chum	10,371	1984-1986	4,517	15,800	6,882
Masset Community Development Project					
Coho	679	1984-1985	265	9,000	3,528
Chinook	1,710	1984-1987	1,368	6,500	3,110
Chum	--	--	--	640	274
Sockeye	111	1984-1987	63	800	442

*Includes facilities constructed prior to SEP.
N/A means "not available."



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North Coast

1. Six people were employed on a job creation project sponsored by the Kitwancool Band. In addition to other enhancement activities, the crew provided coho eggs for planting in the Kitwanga River.
2. The Kispiox Band hatchery employees and a job creation crew started constructing a log hatchery building.
3. A volunteer project in Terrace for coho enhancement.

North Coast

Terrace Community Development Project

A project manager trainee for a CEDP facility near Terrace was hired by the Kitsumkalum Band Council in July 1982 under the Local Employment Assistance Program (LEAP). In addition to attending courses on various aspects of salmonid enhancement, the trainee also undertook an evaluation of enhancement potential and strategies for the Kitsumkalum River.

Funding from the Special Employment Initiatives Program will permit complete development of this project by March 31, 1984. The Terrace/Kitsumkalum Salmonid Enhancement Society was formed to involve the community at large and to undertake the project through a contract with the Department of Fisheries and Oceans.

It is anticipated that this project will provide 375 weeks of employment in the Terrace area by March 31, 1984. Enhancement targets are still being set; however, a small hatchery will be built in time for incubation of 1983 brood year chinook and coho.

Contact: Bruce Wright, Project Coordinator, Special Projects Division.

Kitsumkalum Pilot Hatchery

This pilot hatchery is located on Dry Creek, some 60 km north of Terrace. It has been operated since 1980 in order to provide advance fish culture data for Skeena River stocks.

It was hoped to release two lots of fish of different size or time of release in 1981/82. Various operational problems, however, such as fouling of the recirculating water heaters with fish and food wastes resulted in no significant difference between the size or timing of release groups in the spring of 1982, although some gains in the knowledge of cold water culture techniques were made. In addition, release occurred at a different site for each stock, which probably will confound any adult return results. The pilot was modified over the summer of 1982, to ensure the production of fry of significantly different size at the time of release. Heath trays were installed to completely replace the gravel incubators used previously, and to better control the ponding of the fry. The same release site will be used for all fish in 1983.

Contact: Don MacKinlay, Design Biologist; Dave McNeil, Stock Enhancement Officer, Enhancement Operations.

Zymoetz River Pilot Hatchery

For the second year, chinook fry were reared at this small hatchery located at the confluence of Serb and Fossil Creeks on the Zymoetz River. Approximately 85,000 fed fry were released in July and August. In addition, an estimated 50,000 unfed fry may have escaped into a side channel during emergence. Of the reared fry, 27 percent were tagged and released into a side channel of the lower Zymoetz River, and 43 percent were tagged with a distinctive code and scatter-released up to three km below Fossil Creek. The remaining fish were released near the rearing site and were not tagged.

In August, the egg-take for 1982 brood stock was again conducted on the lower Zymoetz River. Approximately 140,000 eggs were planted in gravel boxes in Terrace. Up to October, when the eyed eggs were shocked, picked and transported to the hatchery site for further incubation and rearing, egg survival was 81 percent. The fry will be fed and reared until late July 1983 when they will be tagged and released into the Zymoetz River.

Contact: Matthew Foy, Biologist,
Special Projects Division.

Kispiox Band Project

The Kispiox project, located on the Kispiox Reservation at the confluence of the Skeena and Kispiox Rivers, is designed to increase the chinook and coho (and potentially steelhead) stocks of the Kispiox River.

In 1982, the Band incubated 131,000 chinook and 119,000 coho eggs. They released 34,728 chinook smolts and 28,227 coho fry at an average survival rate of 27 percent. The Kispiox facility originally operated with surface water; however, constant water quality problems which resulted in poor survival initiated a search for good groundwater sites in the Kispiox Valley. One of the most promising sites was located on the Kispiox reserve at the confluence of the Skeena and Kispiox Rivers. Most of the work done at Kispiox in 1982 was related to well drilling and the construction of a log hatchery/office building with the capacity to incubate and rear 300,000 chinook smolts and 200,000 coho fry annually.

In 1983, the Band expects to complete hatchery construction. During the first year of operation of the new hatchery, 100,000 chinook eggs and 200,000 coho eggs will be incubated. This project provides employment for six Band members.

Contact: Don MacQuarrie, Head,
Community Economic
Development Program, Special
Projects Division.

Babine Facilities

The Babine Lake spawning channels and river flow control facilities were initiated as the Babine Lake Development Project in 1962. Earlier studies had indicated that the main basin of the lake could rear more sockeye fry than the rivers and streams flowing into the lake could produce. The project was designed to produce an additional 100 million fry to rear in the lake, and thus increase the size of the Skeena River sockeye run. At full capacity, the channels have exceeded the fry production targets, averaging 120 million fry annually. Computer models estimate the contribution to the adult escapement and Canadian commercial fisheries at 800,000 fish annually.

The record fry production from the Development Project totalled 237.8 million. Adult escapement to the Babine River system was 1.3 million fish.

Fulton River

Fry production from the Fulton River system in 1982 was average. An unexpected algal bloom caused low egg-to-fry survival in Channel 2. Fortunately, this lost production was compensated for by high natural survival in the river itself and in Channel 1. IEC-BEAK Consultants Ltd. identified the growth as a composite of diatoms, green algae and a fungus. Further studies will be carried out to identify its source and to develop methods to control the growth should this problem occur again.

Adult escapements to the Fulton River system totalled 400,000 sockeye, resulting in an excess escapement which spawned in the lower reaches of the river. Both spawning channels were filled to capacity in 1982.

Pinkut Creek

Fry production from the Pinkut Creek system in 1982 totalled 99.7 million fry. The 82.9 percent egg-to-fry survival in the channel was exceptional.

Such survivals usually occur only in the pristine conditions of a new spawning channel.

Adult escapement to the system was 152,000 fish. The spawning channel was filled to capacity. Some 28,000 adult sockeye were airlifted above the falls to spawn in the upper reaches of Pinkut Creek. Excess spawners in the lower river spawned along the lake shore in the vicinity of the river mouth.

Contact: Colin Harrison, Stock Enhancement Officer, Enhancement Operations.

Kincolith Band Project

The hatchery at Kincolith, near the mouth of the Nass River, suffered severe water problems during 1981 which resulted in a total loss of 1981 brood year chinook and coho. As a result, a new water supply was installed during 1982. This consists of an infiltration gallery in the bed of the Kincolith River and associated electric pumps and back-up generator. This system is used whenever there is a significant risk of freeze-up; otherwise, the gravity feed system from 500 Mile Creek continues to be used.

Other improvements to the hatchery were the installation of a new hatchery floor, Heath trays and Capilano troughs required to bring the hatchery to its planned capacity of 300,000 chinook eggs, 150,000 coho eggs and 100,000 chum eggs. Another building, moved to the site by a crew hired under a job creation program, will provide washroom and storage facilities.

Because of the changes required to the water system, 1982 operations were limited to collection and incubation of 129,000 coho eggs. During 1983, both coho and chinook will be incubated and an investigation of potential side channel work will be conducted.

This project provides employment for two people full-time and up to eight people part-time, working for the Kincolith Band Council under a contract with SEP.

Contact: Bruce Wright, Project Coordinator, Special Projects Division.

Morice River Reconnaissance

The reconnaissance data from 1978/80 in-house studies of juvenile migration and rearing, coded-wire tagging of pen-reared fry, and adult spawning are being compiled into a formal report which should be available in 1983.

Contact: Bruce Shepherd, New Projects Coordinator; Gordon Bérézay, Operations Support Biologist, Enhancement Operations.

Tuya River Feasibility

A comprehensive enhancement strategy was developed for this Stikine River tributary in conjunction with planning exercises completed for continuation of the SEP Program. The proposed enhancement sequence involves winter ground surveys to establish temporary incubation stations. Chinook, coho, and sockeye from the most suitable Stikine stocks would be transplanted to these stations. Once adults returned, "trap-and-truck" methods would be used to transport spawners into the Tuya River system until fishway(s) were constructed. Proposals made late in 1982 by the Northwest Enhancement Society, a group composed of concerned residents of Telegraph Creek, could assist in implementing this proposed enhancement strategy.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations; Gary Logan, Head, Small Projects Unit, Special Projects Division.

Whitehorse Rapids Mitigation Facility

At the request of other departmental groups involved, the Enhancement Operations group has provided input into the design of a facility at Whitehorse, to mitigate losses caused by their hydroelectric facility. It is being built by the Northern Canada Power Commission (NCPC). Responsibilities for the operation of this facility are presently under negotiation with the Habitat Management Division. This 500,000-egg facility will release 360,000 chinook fry at a weight of 1-2 g to rearing streams above the Whitehorse River reservoir. Brood stock will be captured in the fishway at the hydroelectric dam. The facility has both groundwater and gravity-fed water supplied to an aeration tower which feeds Heath tray incubators and Capilano-style rearing troughs. Everything is housed in a building owing to severe winter conditions in Whitehorse. The building also provides basic office, lab, food-storage, and washroom areas, as well as a back-up generator. This facility, which is slated for completion in March 1982, should be valuable to SEP in that present experience with fish culture in Canada's northern regions is very limited. There is considerable uncertainty, however, as to when this hatchery will start operations, due to funding difficulties being experienced by the NCPC.

Contact: Bruce Shepherd, New Projects Coordinator, Enhancement Operations.

Provincial Status Report

Skeena River Steelhead Modelling

In 1982, the Fish and Wildlife Branch launched a program to compile all current information pertaining to the status of Skeena River summer-run steelhead stocks. The overall objective was to relate, on a stock-specific basis, the present steelhead population size to the historic population size. In addition, the smolt capacity of Skeena River streams was examined. Three general tasks were established:

- estimate the size of the present steelhead population
- reconstruct the historic stock size
- determine stream smolt production capacity.

Modelling of steelhead carrying capacity in the Skeena River watershed focussed on the third objective.

The estimated smolt yield of summer-run steelhead was calculated for the entire Skeena River watershed (upstream of Terrace) on a stream-specific basis. These estimates were obtained by applying habitat-based steelhead smolt yield models to available data sources. Modelling was applied to estimated habitat values in each known steelhead system to the limits of suspected steelhead distribution.

A number of smolt production models were developed and tested. All results are preliminary, and further modifications are anticipated. In 1983, the models will be improved using field data collected in selected Skeena River tributaries.

Contact: Dave Tredger, Fisheries Biologist, Fish Habitat Improvement Section, Fish and Wildlife Branch, Victoria.

Skeena River Steelhead

The steelhead program in the Skeena River watershed is a combination of two projects. The first is an annual stock analysis which is derived by sampling juvenile steelhead densities in representative "index streams" throughout the drainage. Results for each year are compared to baseline data which have been developed over three previous years of sampling. This information provides a more refined estimate of juvenile densities and survival for each age class, as well as expected smolt production and a forecast of adult returns. Areas with low juvenile densities are isolated and, depending on the circumstances, may be candidates for fry stocking projects.

The second component of the Skeena steelhead program is the actual fry stocking. Although several systems have been stocked in past years, the major project for 1982 was the Suskwa River. Harold Price Creek, a tributary of the Suskwa, was identified as a major enhancement opportunity in the Bulkley River system. Although partially removed in 1978, a series of waterfalls still hamper the passage of anadromous fish into the upper portion of the system. Recent work has established that this area is suitable for juvenile steelhead. Pilot projects in 1979 and 1980 released 15,000 and 11,000 fry respectively, into the area above the falls. Follow-up assessment work has indicated that these fish are thriving, so a larger fry stocking project was initiated for 1982.

In 1982, juvenile sampling and standing stock analysis was carried out on the Kispiox, Suskwa, Morice, Zymoetz and Bulkley River systems.

For the fry stocking project, brood stock from the Suskwa River were collected in the spring and kept in aluminum isolation boxes. The fish were spawned in June, and the fertilized eggs sent to Fraser Valley trout hatchery. The resulting fry were then returned to Harold Price Creek by truck for planting above the falls. The 49,000 fry were distributed by hand and a helicopter was used to drop crews into inaccessable areas.

In 1983, the Zymoetz (Copper) and Morice Rivers will be stocked with steelhead fry.

Contact: Mike Lough, Fisheries Biologist, Fish and Wildlife Branch, Smithers.

Kispiox River Steelhead Reconnaissance

Regional fisheries managers in Smithers have identified management problems and goals for Kispiox River steelhead stocks. Earlier regional studies and a steelhead radio-tagging program identified 14 Kispiox tributaries as potential sites for natural or seminatural enhancement. In 1980, a detailed biophysical reconnaissance of these 14 tributaries and selected areas of the mainstem Kispiox was conducted in an effort to outline steelhead carrying capacity and to identify opportunities for enhancement. Results of the 1980 investigations suggested that management and future enhancement should be based on an annual assessment program and not on the basis of only one year of data.

In 1981, an annual assessment program was initiated to monitor changes in juvenile steelhead population in late summer. The estimated fry population was 98 percent higher in 1981 than in 1980, with fry to parr survival estimated at 26 percent for the intervening year. A third consecutive year of sampling in 1982 was recommended for the determination of optimum fry recruitment in the Kispiox system.

Fish population estimates, by electrofishing, were obtained at 15 index sites in the mainstem Kispiox River and its tributaries. This represented a slight expansion on the 1981 sampling program. Snorkel survey observations were also collected. Analysis of the 1982 field data has not been completed.

A summary report will include three years of steelhead fry population estimates and annual survival rates between age groups. An attempt to outline optimum seeding rates will be made.

Contact: Dave Tredger, Fisheries Biologist, Fish Habitat Improvement Section, Fish and Wildlife Branch, Victoria.

Bulkley River Steelhead

The Bulkley River, a large tributary of the Skeena River, is one of the major steelhead rivers in B.C. Recent radio-tagging studies throughout the Skeena River drainage have indicated that the Bulkley River steelhead are intercepted in the salmon gillnet fishery at the mouth of the Skeena near Prince Rupert. It is anticipated that these commercial interceptions of steelhead may increase in future years as major salmon enhancement projects reach full production.

In order to compensate for these interceptions of future enhanced steelhead, a detailed survey of steelhead in the Bulkley River was initiated in 1982. The project was broken down into two related studies. One part was a tagging program which combined spaghetti-tagging with radio-tagging to provide a better understanding of movements of steelhead within the sport fishery. The second study was a creek survey of steelhead anglers, which not only revealed where the angling effort occurred, but also monitored recoveries of spaghetti-tagged steelhead.

Three hundred and seventeen steelhead were spaghetti-tagged in the Bulkley River and an additional six fish were radio-tagged. To date, 21 of these steelhead have been recaptured in the sport fishery, but more recaptures are anticipated when repeat spawners are intercepted as they return to the Skeena and are caught in the salmon fishery near Prince Rupert. Data from the creel survey are currently being summarized and will be combined with a second year of data before a final report is produced in 1983.

Contact: Mike Lough, Fisheries
Biologist, Fish and Wildlife
Branch, Smithers.

Upper Bulkley River Steelhead Enhancement

The upper Bulkley River is upstream from the Morice River confluence near Houston.

Bioreconnaissance of the system was conducted in late summer of 1981. Objectives were to outline present fish stocks and to estimate the carrying capacity for juvenile steelhead. No reliable information on adult steelhead spawning escapements or distribution was available. Very rough estimates of steelhead distribution and juvenile numbers were made. Populations of approximately 92,000 fry and 48,000 parr were estimated, translating into an adult escapement of 155 to 1,260 spawners. The major problem in determining steelhead distribution and numbers was the uncertainty in separating juvenile steelhead and resident rainbow trout populations. A recommendation was made for further assessment to determine steelhead distribution and the ratio of resident trout to steelhead.

A very brief census of juvenile rainbow populations at 7 index sites along the upper Bulkley River was conducted in August 1982. Population estimates by electrofishing were conducted in Richfield Creek, Buck Creek, McQuarrie Creek and the Bulkley River mainstem. Analysis of this data has not yet been completed.

Contact: Dave Tredger, Fisheries
Biologist, Fish Habitat
Improvement Section, Fish and
Wildlife Branch, Victoria.

Suskwa River Steelhead Enhancement

Harold Price Creek, a major tributary of the Suskwa River, drains into the Bulkley River near Hazelton. Historically, an impassable falls blocked fish access to 81 km of suitable habitat in Harold Price Creek and its major tributary, Blunt Creek. The obstruction was modified in 1978 and 1979 by blasting to permit adult passage, and fry were stocked above the falls in 1979 and 1980.

Evaluation of the Suskwa River steelhead enhancement program began in 1981 with an assessment of the dispersal and survival of released fry. The released fry were not abundant and wild steelhead were not above the falls. The optimum stocking density was estimated to be 0.4 fry/m^2, for a total stocking requirement of about 340,000 fry.

A brief reconnaissance of the Harold Price Creek watershed was conducted on August 30, 1982. Fish population estimates and habitat data were collected at 12 sites in selected reaches. Objectives included estimates of the numbers of juvenile steelhead present above the falls (both hatchery releases and wild fry), and the collection of background information on rearing habitat and fry requirements. No wild or hatchery steelhead were found above the falls in the Harold Price Creek. Hatchery released fry (now two and three years old) may have migrated downstream or may be present at extremely low density. The lack of wild fry above the falls indicates no natural recruitment, and suggests the falls remain impassable to adult steelhead.

The estimated fry stocking requirement for upper Harold Price Creek was 170,000 fish, or 2.09 fry/linear m.

Contact: Dave Tredger, Fisheries
Biologist, Fish Habitat
Improvement Section, Fish and
Wildlife Branch, Victoria.

Morice River Steelhead Enhancement
Assessment of steelhead enhancement opportunities in the Morice River system began in 1980. At that time, efforts were concentrated on two important steelhead spawning tributaries, Owen and Lamprey Creeks, with only limited effort in other tributaries of the Morice River system. The 1980 assessment confirmed that Owen and Lamprey Creeks were important tributaries for the spawning and early rearing of steelhead. The age distribution of juvenile steelhead suggested that these two streams were also important for the production of yearling and two-year-old parr migrants for rearing to the smolt stage in the mainstem Morice River. Recommendations resulting from the 1980 assessment included an annual fry recruitment monitoring program at selected index sites and further analysis of the entire Morice system to obtain a complete picture of Morice River steelhead production and enhancement opportunities.

The Morice River assessment program was conducted in August 1982. Twenty-nine index sites were sampled and population estimates were obtained by electrofishing. Streams sampled included Owen Creek, Lamprey Creek, Gosnell Creek, Shea Creek, Houston Tommy Creek, the Thautil River and the mainstem Morice River. Analysis of the 1982 field data has not been completed.

Contact: Dave Tredger, Fisheries
Biologist, Fish Habitat
Improvement Section, Fish and
Wildlife Branch, Victoria.

Job Creation Projects

Skeena River Fish Quality
Aquatic Resources Ltd. sponsored a project involving three people to investigate fish quality and possible terminal fishery sites on the Skeena River.

Prince Rupert Shoreworkers Project
Nine people were employed by the Prince Rupert Amalgamated Shoreworkers & Clerks Union to determine coho spawning escapements to streams in the Prince Rupert area.

Northwest Steelhead Society
Eight residents of Terrace were employed by the Steelhead Society to construct a 50,000-egg incubation box, a counting fence, and a holding pen for Spring Creek coho.

The crew also cleared beaver dams and other obstructions from Spring Creek to allow salmonids to utilize the stream up to the dam.

Some 25,000 coho eggs were initially planted in the Spring Creek incubation box, but due to freezing problems, these eggs were moved to the Eby St. hatchery, a volunteer project.

The crew also carried out stream inventories which will aid the development of the Terrace-Kitsumkalum Salmonid Enhancement Project.

Kitsumkalum Project
The Band Council employed four people to conduct bioreconnaissance studies on the Kitsumkalum River and its tributaries.

The crew also salvaged approximately 1,000 coho and chinook fry from isolated frozen ponds and released them into the Kitsumkalum River. This project also worked in conjunction with the Terrace-Kitsumkalum Salmonid Enhancement Project to develop a small enhancement facility.

Kispiox Hatchery Project
The Kispiox Band employed eight people to assist the hatchery crew with the rearing and release of 70,000 chinook and 100,000 coho fry. The crew also assisted with the tagging of some 100,000 fry.

The crew also helped construct a new log hatchery building.

Kitwancool Project
The Kitwancool Band Council employed six people to conduct river surveys and identify major obstructions in Kitwanga River.

Some 65,000 coho eggs were taken from Kitwanga River stock and incubated in Heath trays located in the basement of the old school building. A classroom incubator was also set up in the elementary school. In addition, the students helped plant 10,000 eggs in the gravel of the Kitwanga River.

The project also provided 15,000 eggs for students at a salmonid enhancement training course to plant into the Kitwancool River.

Kincolith Project
The Band Council employed eight people to clear access trails along the Kincolith River and to construct a hatchery building for their Community Economic Development Project.

Greenville Project
The Lakalzap Band Council employed twelve people to determine salmon spawning escapements and to clear stream obstructions to allow adult migration into underutilized stream habitat.

A small incubation box was installed in the basement of the Band Council building to ensure that the water supply did not freeze. Some 20,000 coho eggs were incubated. A small rearing facility will be built in conjunction with the elementary school.

Some members of the band will also conduct a study of eulachon spawning and rearing habitat.

Contact: Rob Brouwer, Project
Developer, Job Creation Unit,
Special Projects Division.

Table 36

Public Participation Projects

NORTH COAST PUBLIC PARTICIPATION PROJECTS

Location	Name of Group	No. of People Involved in 1982	No. of Years Group Involved In SEP	Type of Project	Species	Juveniles Released	% Survival	Expected Adult Production from 1982 Releases
Kloiya Creek	Northern Trollers Assn.	15	4	incubation	chinook	4,700	39[1]	93
Diana Creek	Northern Trollers Assn.	12	4	incubation	coho	18,750	75	225
Lakelse River	Uplands Elementary School	22	1	incubation in school, construction	coho	Did not operate till 82/83.		
Lakelse River/ Thornhill Creek	Thornhill Elementary School	30	1	incubation in school, construction	coho	Did not operate till 82/83.		
Lakelse River/ Thornhill Creek	Caledonia Secondary School	25	2	incubation	coho	No eggs incubated in 1981.		
Lakelse River/ Thornhill Creek	Copper Mountain Elementary School	32	1	incubation in school	coho	Did not operate till 82/83.		
Thornhill Creek	Clarence Michiel School	130	3	incubation in school	coho	750	75	9
Thornhill Creek	Skeena Junior Secondary School	10	1	incubation in school, construction	coho	Did not operate till 82/83.		
Thornhill Creek	James Wold	10	3	incubation	coho	120,000	52	1,440
Tseax River	Uplands Elementary School	40	1	incubation in school, construction	coho	Did not operate till 82/83.		
Spring Creek/ Kitsumkalum River	Steelhead Society, Northwest Chapter	12	4	incubation, stream improvement, construction	coho	Did not operate till 82/83.		
Telkwa River	Steelhead Society, Bulkley Valley Chapter	6	5	information, research	steelhead	—	—	—
Bulkley River/ Morice River	Tadek Then	1	2	incubation, research	chinook	352	44	21
Morice River/ Upper Bulkley River	Emerson Creek Hatchery	—	2	incubation	chinook	47,000	33	846
Greenville Creek	Greenville Elementary School		1	incubation in school	coho	Did not operate till 82/83.		
Tseax River	Nishga Elementary School	11	4	incubation in school	coho	No eggs taken in 1981.		
Rainy Creek	Stewart Secondary School Science Class	18	1	incubation in school	coho	Did not operate till 82/83.		

Contact: Barry Peters, SEP Community Advisor.

[1] Poor quality eggs due to poor donor stock.

Table 37

North Coast SEP Facilities*: Juvenile Releases 1982

Species	Brood	Group	Total Released	% Marked	% Survival	Average Size(g)
Kitsumkalum Pilot Hatchery						
Chinook	1981	Cedar Cr.	62,000	62	95.4	0.8
Chinook	1981	Kitsumkalum R.	128,000	53	88.3	0.85
Zymoetz River Pilot Hatchery						
Chinook	1981	Zymoetz R.	85,157	75	69	1.96-2.53
Kispiox Band Project						
Coho	1981	Kispiox R.	28,227	0	27	5.0
Chinook	1981	Kispiox R.	34,728	90	27	6.5
Babine Facilities						
Sockeye	1981	Fulton Channel 1	12,300,000	--	51.9	0.137
Sockeye	1981	Fulton Channel 2	53,300,000	--	26.9	0.144
Sockeye	1981	Fulton R.	72,200,000	--	24.0	0.149
Sockeye	1981	Pinkut Channel	57,700,000	--	82.9	0.147
Sockeye	1981	Pinkut Cr.	42,000,000	--	24.9	0.142
Kincolith Band Project						
No 1982 releases due to 100% mortality from water problems.						

*Includes facilities constructed prior to SEP.

Table 38

North Coast SEP Facilities*: Status at December 1982

Species	Stock	Brood	Stage	No. on Hand	Expected Release Date	Expected Release Number	Expected Release Site
Kitsumkalum Pilot Hatchery							
Chinook	Cedar R.	82	egg	45,000	April 1983	40,000	Dry Cr.
Chinook	Kitsumkalum R.	82	egg	77,000	April 1983	63,000	Dry Cr.
Chinook	Clear Cr.	82	egg	45,000	April 1983	40,000	Dry Cr.
Zymoetz River Pilot Hatchery							
Chinook	Zymoetz R.	82	egg	112,000	July-Aug. 1983	112,000	Zymoetz R.
Kispiox Band Project							
No egg-takes in 1982; a new facility is under construction.							
Babine Facilities							
Sockeye	Fulton R.	82	egg	430,000,000	May 1983	100,000,000	Fulton R.
Sockeye	Pinkut Cr.	82	egg	200,000,000	May 1983	70,000,000	Pinkut Cr.
Kincolith Band Project							
Coho	Kincolith R.	82	egg	129,000	Aug. 1983	110,000	Kincolith R.

*Includes facilities constructed prior to SEP.

Table 39

North Coast SEP Facilities*: Surplus Sales 1982

Species	Amount of Fish (kg)	Eggs (number)	Native Food Fish (pieces)	Value ($)
Babine Facilities				
Sockeye	0	600,000	0	--[1]

*Includes facilities constructed prior to SEP.
[1] No payment received; provided for research purposes.

Table 40

North Coast SEP Facilities*: Escapement to Facility 1982

Species	Escapement to Facility	Spawned for Hatchery Stock		% Marked
		male	female	male and female
Babine Facilities				
Sockeye (Fulton)	400,000	natural spawning		--
Sockeye (Pinkut)	152,000	natural spawning		--

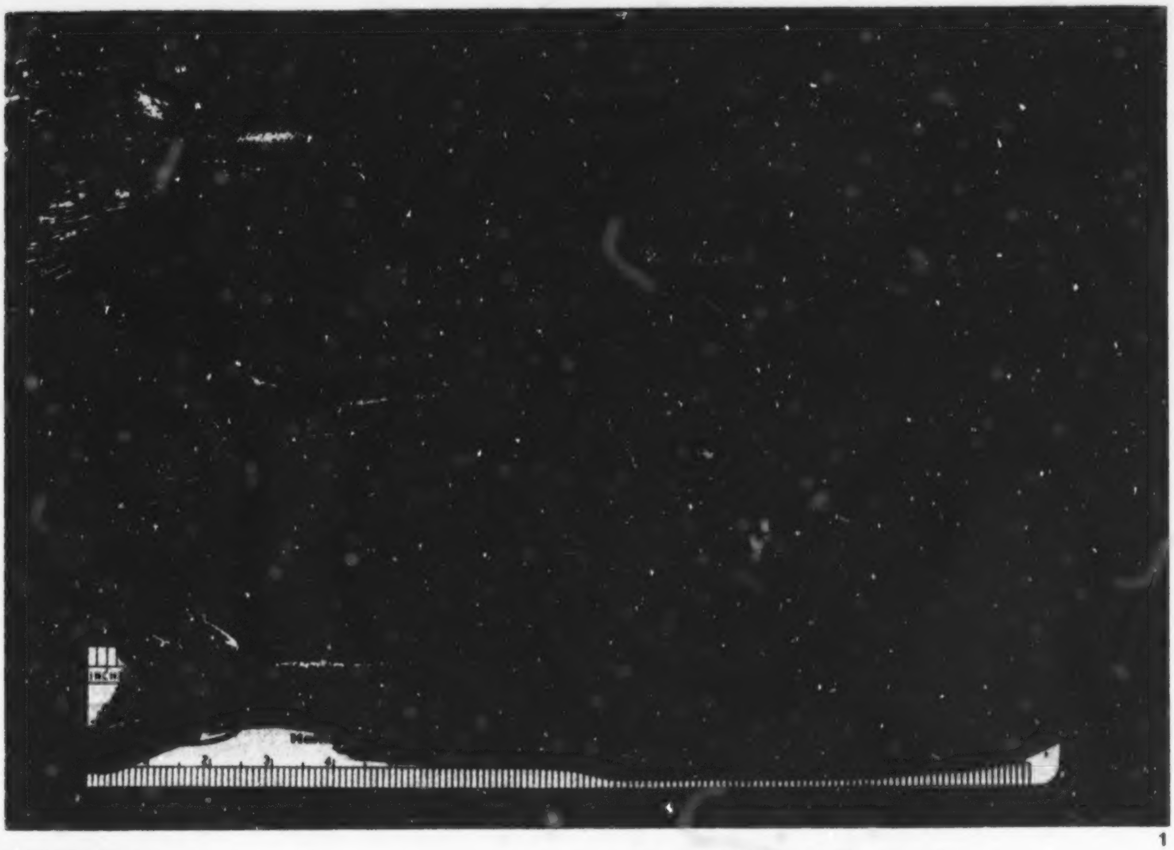
*Includes facilities constructed prior to SEP.

Table 41

North Coast SEP Facilities*: Adult Production

	Expected Production from 1982 Releases			At Full Production	
Species	Total Adult Production	Years of Return	Contribution to Fisheries	Total Adult Production	Contribution to Fisheries
Kitsumkalum Pilot Hatchery					
Chinook	1,181	1983-1987	432	N/A	N/A
Zymoetz River Pilot Hatchery					
Chinook	2,522	1984-1986	923	700	4
Kispiox Band Project					
Coho	294	1984-1985	191	15,100	6,369
Chinook	1,002	1984-1987	611	10,800	1,449
Steelhead	--	--	--	1,000	525
Babine Facilities					
Sockeye (Fulton)	1,369,170	1984-1986	572,313	1,125,000	470,250
Sockeye (Pinkut)	987,030	1983-1986	412,578	540,000	225,720
Kincolith Band Project					
Coho[1]	--	--	--	6,100	2,871
Chinook[1]	--	--	--	6,500	2,216
Chum	--	--	--	23,900	12,740
Pink	--	--	--	52,400	36,756

*Includes facilities constructed prior to SEP. N/A means "not available."
[1] No 1982 releases due to 100% mortality from water problems.



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2

Federal Research

1. *These steelhead smolts were raised in a side channel. The missing adipose fin denotes the presence of a nose tag.*
2. *SEP researchers have created all-female and sterile groups of salmon.*

Federal Research

Juvenile Production Strategies

Size and Time at Release

The purpose of these studies is to determine the optimum size and time at release for juvenile salmonids in order to obtain maximum adult returns. An early coho study at Rosewall Creek experimental hatchery has demonstrated the importance of both factors.

Experiments are now in progress at Quinsam and Capilano production hatcheries. A series of releases has been repeated twice at each location to assess the variability of results between years. In addition, a series of releases of chinook was made from the Quinsam hatchery in 1982.

a) Quinsam hatchery coho studies

The first series of coho releases was made in 1980. Smolts of three sizes (small, medium, and large) were released on four dates (April 20, May 10, May 30, and June 19). A preliminary analysis of the contribution of these various release groups to the fisheries and to hatchery escapement has been completed. The highest return of coho jacks (precocious males) resulted from the largest smolts for each release date. Later releases of smolts of any size resulted in a lower return of jacks than from smolts of the same size released at an earlier date. In general, the proportion of jacks contributing to the total return (jacks plus adults in the catch and escapement) increased rapidly with increasing smolt size. For example, in the May 30 release, 20-g smolts produced virtually no jacks, whereas more 28-g smolts returned as jacks and made up about 20 percent of the total return. These data indicate that the percent returns of adults in the total escapement from the four releases were: April 20, 3.0 percent; May 10, 4.7 percent; May 30, 8.7 percent; and June 19, 2.1 percent. Therefore, the highest return of adult coho originated from the May 30 release. These data also indicate that for fish released on April 20 and May 10, an inverse relationship exists between smolt size and percent adult returns. In each case the smaller smolts returned better as adults than did the larger smolts. For the coho releases on May 30 and June 19, smolt size had no effect on adult returns. There was a decrease in the overall mean size of adults when smolts were released progressively later. For example, the mean weight in kilograms of adults from the various releases is as follows: April 20, 3.18; May 10, 2.71; May 30, 2.29; June 19, 1.92. There was also a strong tendency within each release group for smolt size at release to influence adult size; that is to say, small smolts produced smaller adults than did the large smolts. Overall, there was no significant difference in the catch to escapement ratio between releases (78 to 82 percent). However, within each of the first three releases, there was a tendency for the fisheries to select fish originating from the larger size smolts.

A second series of coho releases was made in 1981. The release dates were identical to those in 1980, and the fish were again classified into small, medium and large categories. The recovery of jacks and adults from these releases was completed in the fall of 1981 and 1982. Preliminary examination of the jack escapement data indicates that the largest smolts again produced the greatest return of jacks. In 1981, the highest jack return originated from the May 30 release in 1980, whereas in

1982, the highest jack return originated from the May 10 release in 1981. Preliminary examination of the adult escapement data indicates that the highest percent return of adults occurred from the May 30 release in 1981 as in 1980. Again, for fish released on May 30 and June 19, smolt size had no effect on adult returns. Analysis of the data resulting from the 1981 releases will be completed in 1983.

b) Capilano hatchery coho studies

The first series of coho releases was made in 1981. Smolts of three different sizes (small, medium, large) were released on four dates (May 7, May 28, June 18, July 9). Counts of jacks recovered in the fall of 1981 indicated that for three of the four releases, the largest smolts again produced the highest jack returns. In the fall of 1982, adults from the 1981 releases were recovered in escapements to the hatchery. Preliminary examination of the adult recoveries in the escapement (up to October 20, 1982) showed the percent returns of adults from the various releases were: May 7, 0.32 percent; May 28, 0.76 percent; June 18, 0.73 percent; and July 9, 0.50 percent. For coho released on May 28 and July 9, smolt size had no effect on adult returns. For those released on May 7 and June 28, however, smolt size had some effect on adult returns, with a greater representation of the medium-sized fish (about 20 g) from the June 18 release, and the small-sized fish (about 15 g) from the May 7 release. A second series of coho releases was made in 1982, with the release dates identical to those used in 1981. The fish were again classified into small, medium and large categories. Jacks were recovered in the fall of 1982.

c) Quinsam hatchery chinook studies

Chinook size and time at release studies were initiated at Quinsam hatchery in 1982, with the release of juveniles of three sizes (small, medium, large) on four dates (May 5, May 26, June 16, and July 7). A total of 315,986 marked and tagged fish were released. A second series of similar releases will be made in 1983.

Steelhead Parental Age Studies

These studies are designed to examine the influence of environmental and genetic factors in determining the age of steelhead trout at maturity. This information will permit hatcheries to manipulate the age at maturity to achieve specific objectives. For example, hatcheries could produce trout with a longer ocean residence, so that they return as trophy-sized fish desired by anglers.

a) Rosewall Studies

In spring 1979, the first steelhead release was made from Rosewall Creek hatchery. These fish were the progeny of two groups of parents; one group (both male and female) had spent three years in the ocean, and the other group two years before returning to spawn. Progeny from each group were divided into three size classes (small, medium, large) and marked distinctively with coded-wire tags prior to release. The adults with two years of ocean residence (2-ocean adults) returned to Rosewall in the spring of 1981, whereas the older (3-ocean) adults returned in the spring of 1982.

A total of 192 tagged 2-ocean adults were recovered in 1981, and a total of 44 tagged 3-ocean adults were recovered in 1982. Preliminary examination of the 1981 and 1982 returns indicated that smolt size at release has a very strong influence on the total percent return of both 2-ocean and 3-ocean fish. Overall survival increased with increasing smolt size. Maximum returns (0.68-0.81 percent) originated from 52 and 55-g smolts, whereas no adults returned from the 12-g smolts. The total return of progeny from 2-ocean parents was 2.7 times that from 3-ocean parents. Males predominated (71.3 percent among the 2-ocean adults, and females predominated (65.9 percent) among the

3-ocean adults. Therefore, there is a strong tendency for males to return at an early age (2-ocean) and females to return one year later as 3-ocean fish. The percentage of 2-ocean adults in the total return from the six progeny groups from 2-ocean parents indicated that there was no relationship between smolt size at release and the proportion of 2-ocean fish in the return. Among the six progeny groups from 3-ocean parents, however, there was a strong suggestion that size of smolts at release influenced the proportion of 2-ocean fish in the total return; that is to say, the proportion of 2-ocean fish increased as smolt size increased. When all 12 groups are combined, a significant positive correlation ($r = 0.67$, $p < .02$) is observed, which suggests that smolt size at release has a significant influence on the proportion of fish that return as 2-ocean fish.

In the spring of 1980, a second series of time and size releases was made from Rosewall Creek hatchery. Progeny from 2-ocean parents were divided into three size classes (small, medium, and large), tagged, and then released at four dates on April 6, April 26, May 16, and June 5. One group of size-graded progeny from 3-ocean parents was released on April 26. In 1982, a total of 24 tagged 2-ocean adults were recovered. Preliminary examination of the 1982 returns indicated that 13 fish originated from large smolts produced by 3-ocean parents and released on April 26. Among the 11 adults that originated from 2-ocean parents, eight fish resulted from the large smolts released on May 16. No adults returned from the April 6 and June 5 releases, and only three fish returned from large smolts released on April 26. The 2-ocean adults were predominantly males (71 percent). Three-ocean adults from this study will be recovered in 1983.

The initial 1979 experiment was repeated on June 8, 1981, with the release of progeny from both 2-ocean and 3-ocean parents. The trout were again divided into three size classes and tagged distinctively prior to release. Two-ocean adults will be recovered in 1983.

More detailed genetic crosses were made in 1981 to examine the effect of parental age on freshwater growth as well as on the age of progeny at maturity. Thirty-two groups of fish resulting from 2 X 2, 3 X 3, 3 X 2, and 2 X 3 parental ocean-age crosses using four sets of parents were reared separately and sampled at regular intervals. These 32 groups were tagged and released on May 27, 1982. A replicate of this experiment, but with modified experimental design, was made in 1982. These 32 groups have been tagged distinctively and will be released in 1983.

b) Oyster River studies

A single release of 30,000 tagged steelhead smolts was made at the Oyster River in 1981. Returns of 2-ocean adults are expected in 1983. These fish were the progeny of 2-ocean and 3-ocean Oyster River parents and were incubated and reared at Rosewall hatchery. The juvenile trout were divided into three size classes prior to tagging. Another 22,000 Oyster River fish were reared and tagged at Rosewall hatchery and were released in the Oyster River on May 17, 1982.

Contact: Tom Bilton, Research Scientist; Bruce Morley, Biologist; Art Coburn, Technician; Doug Brouwer, Technician; Fisheries Research Branch, Pacific Biological Station, Nanaimo.

Table 42

Fertilizers Added to Treated Lakes

Lake	Tonnes of Nitrogen	Tonnes of Phosphorous	Applied Ratio of Elements
Great Central	20.0	3.0	15N:1P
Kennedy	21.1	1.8	26N:1P
Henderson	12.0	1.8	15N:1P
Hobiton	2.0	0.3	15N:1P
Lowe	2.0	0.3	15N:1P
Awun	2.7	0.4	15N:1P
Eden	2.9	0.4	15N:1P
Ian	7.2	1.1	15N:1P
Bonilla	1.6	0.2	15N:1P
Curtis	5.1	0.8	15N:1P
Long	15.0	2.2	15N:1P
Nimpkish	20.0	3.0	15N:1P
Kitlope	5.8	0.9	15N:1P

Lake Enrichment Program

Treatments

Thirteen lakes in British Columbia were treated for 21 consecutive weeks, during the period of May 9 to September 27, by the aerial application of solutions of commercial agricultural fertilizers.

The application contractor, Conair Aviation Ltd., used a DC-6B aircraft to distribute the fertilizer. Total average flying time for each weekly treatment was 14.2 hours. Flying, except for two occasions when the weather was poor, took place during the first two days of each week.

Other work performed includes the in-house chemical analysis of lake water samples collected by the monitor contractor (J.E. Sager) for assessment of lakes' response to fertilization and for the evaluation of "candidate" lakes prior to fertilization.

Contact: Ken Stephens, Technician,
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Nanaimo.

Juvenile Sockeye Studies

The purpose of these investigations is to assess the effect of lake enrichment on sockeye production. Specific objectives include evaluation of the growth and survival of juvenile sockeye to the smolt stage by monitoring various abiotic and biotic factors (temperature, zooplankton standing crop, growth and density of competitors) clearly linked to sockeye growth and survival and by conducting quantitative comparisons between fertilized and unfertilized lakes.

Hydroacoustic surveys were completed to determine the distribution and relative abundance of limnetic fish populations in 12 lakes undergoing nutrient treatment during 1982. Similar surveys were conducted on six untreated lakes in 1982 (Devon, Kennedy (Main Arm), Mercer, Sproat, Yakoun, Woss) to facilitate comparisons of juvenile sockeye responses between treated and untreated lakes as well as between treated and untreated years within a single lake. Midwater trawling was conducted on most study lakes to collect fish samples to be used for species composition, growth, age and diet studies. Due to cost increases during 1982, surveys of juvenile sockeye were conducted only once on northern systems and two or three times on southern study lakes. Samples of sockeye smolts were collected at outmigration from 15 of the lakes surveyed during 1982.

Enrichment of lakes may have two positive effects on sockeye production. First, growth rate of the fish is improved because the food supply is increased. The improved growth results in the production of larger smolts which should return as adults at a better rate than do smaller fish. Second, better conditions for growth should enable the sockeye fry to experience better survival to the smolt stage so that more smolts result from a given level of fry production.

Changes in the rates of survival of sockeye during lake residence are more difficult to assess than changes in their growth. The main reason that within-lake survival is difficult to assess is the problem of estimating fry input to the lakes. Fry enter the lakes from one or more streams, or may even emerge directly into the lake from shoreline spawning areas. Since direct estimates of fry input are too expensive for routine assessment, we are obliged to rely on a survival index based on the number of eggs present in the parent spawner population and on the number of presmolts present in the lake by fall or late winter. This egg-to-presmolt-survival index is sensitive both to variations in the incubation success of eggs on the spawning grounds and to variations in sockeye fry survival within the lake. Consequently, the index is useful only in following within-lake-survival changes to sockeye in situations where egg incubation success is likely to remain relatively constant. This point may be illustrated with data from the following table which summarizes sockeye survival in three lakes where reliable estimates of spawners and juvenile sockeye are available.

Sockeye survival in Long Lake is lower and more variable than in Great Central and Sproat Lakes. The variability in Long Lake is no doubt due to unstable conditions for egg incubation in the two headwater streams in which sockeye spawn. Consequently, any changes in within-lake survival of fry between treated and untreated years at Long Lake are likely to be masked by large between-year variations in egg incubation success. In Great Central and Sproat Lakes, sockeye spawn predominantly in shoreline locations where eggs and alevins are not subjected to extreme water flow fluctuations. Consequently, egg-to-fry survival should be relatively constant, and between-year differences in the survival index should relate primarily to changes in fry survival within-lake. To complete the data required to assess whether fertilization will generally influence within-lake survival of sockeye fry, index data will have to be obtained for a series of years (three or more) in which Sproat Lake is treated and Great Central is not.

Contact: Dr. Kim Hyatt, Research Scientist; Terry Gjernes, Research Biologist; Fisheries Research Branch, Pacific Biological Station, Nanaimo.

Table 43

Summary of Sockeye Egg-to-Presmolt Survival

Brood Year	Great Central Lake	Long Lake		Sproat Lake
	(Fertilized)	(Fertilized)	(Unfertilized)	(Unfertilized)
	(%)	(%)	(%)	(%)
1976	4.4	1.6		
1977	3.8	1.2		
1978	3.4	2.4		
1979	3.5		2.5	4.0
1980	3.8		1.4	4.3
1981	(incomplete)	1.0		(incomplete)

Adult Sockeye Studies

The objectives of these studies are to:

- evaluate lake enrichment as a cost-effective technique for enhancing adult sockeye production
- determine the effects of lake enrichment on reproductivity and population characteristics (age-composition, survival, age at return, etc.) of treated stocks
- investigate the ecological relationships and mechanisms regulating adult production.

In 1982, 12 lakes in coastal British Columbia had returns of adult sockeye from brood years associated with fertilized lake conditions. In keeping with the program established in 1981 to monitor assessible stocks, studies were limited to five fertilized stocks (Great Central, Hobiton, Henderson, Kennedy and Long) and one unfertilized stock (Sproat). In addition, considerable effort was devoted to collecting information and analysing data useful for increasing the reliability of existing escapement estimates. Definitive assessment of lake enrichment on adult populations will not be complete until comparable information on adults from several untreated and treated brood years becomes available.

Despite the lack of reliable data for untreated stocks, important information is emerging on changes in reproductivity and the biological characteristics of individual stocks for brood years associated with treatment regimes. For example, the runs to Hobiton and Kennedy Lakes have increased annually since 1980 in association with fertilization. The Hobiton run, in 1982, reached historical size. The Henderson Lake stock has also increased progressively since fertilization of the lake. The run to Long Lake was also exceptionally strong. In contrast, however, the run to Great Central Lake was the smallest in recent years and slightly below expectations. The estimated total returns of adults in these stocks in 1982 are presented in the following table along with predicted run sizes based on estimates of survival rates for one-year smolts to 4 and 5-year-old adults. Collectively, actual returns exceeded predicted returns by 576,000 fish, or about 50 percent.

For all stocks, particularly Great Central, Henderson and Long Lakes, 5-year-olds constituted a higher proportion of the run in 1982 than in other years for which data on age composition are available. The relative importance of natural or enrichment events as causal agents in the observed shift in age composition is unknown at this time.

Table 44

Predicted and Observed Sockeye Returns to Five Treated Lakes

Lake	Smolt Abundance (millions) 1979	1980	Total returns in 1982 Predicted*	Observed
Great Central	14.69	6.10	423,000	346,000
Henderson	1.11	2.90	107,000	60,000
Hobiton	0.35	0.34	12,000	75,000
Long	3.60	3.10	153,000	500,000**
Kennedy	1.64	1.70	78,000	120,000**

* Predictions based on preliminary survival estimates of 1.6 percent for presmolts to age 1.3 and 2.2 and 3.07 percent to age 1.2.

** Information provided by Field Services Branch.

Contact: Dr. Kim Hyatt, Research Scientist; Jim Manzer, Biologist, Fisheries Research Branch, Pacific Biological Station, Nanaimo.

Limnology

Thirteen lakes (Awun, Bonilla, Curtis, Eden, Great Central, Henderson, Hobiton, Ian, Kennedy-Clayoquot Arm, Kitlope, Long, Lowe and Nimpkish) were fertilized in 1982. Fertilizer was added to the lakes once weekly from May to September in a nitrogen:phosphorus ratio of 15:1, except in Kennedy-Clayoquot Arm, where the N/P ratio was 26:1. Sampling for a number of physical, chemical and biological variables was carried out on most of these lakes once monthly from April to October, and the effects of fertilization were assessed. Algal biomass and productivity increased in response to fertilization in all thirteen lakes, and in most lakes these increases are now predictable.

Only a portion of the phytoplankton community (nanoplankton) is suitable as a food source for zooplankton, and in several lakes it was evident that after several years of fertilization, most of the added nutrients were being taken up by the inedible fraction of the phytoplankton community (netplankton). In 1982, fertilization strategies were altered on several lakes in an effort to reverse this trend, and results indicate these altered strategies were successful, in that the proportion of nanoplankton increased and the netplankton decreased. These modified strategies, which include changes in fertilizer composition, application frequency, duration, and dosage, will be used on most lakes in 1983, and they should result in the more efficient transfer of energy from added nutrients to edible phytoplankton, on to zooplankton and finally, to juvenile sockeye.

Four unfertilized lakes (Simpson, Sproat, Woss and Yakoun) were also studied in 1982, and results indicate that all but Simpson are favorable candidates for fertilization. Yakoun Lake will be fertilized in 1983, and a decision is pending regarding the fertilization of Sproat and Woss Lakes.

Contact: Dr. John Stockner, Associate Director; Ken Shortreed, Biologist, Fisheries Research Branch, West Vancouver Laboratory.

Table 45

Sockeye Smolt Production[1] from Lake Enrichment in 1982 and Adult Production at Design Capacity[2]

Lake	Juveniles Released	Expected Adult Production	At Design Capacity		
			Adult Prod. (pieces)	Catch (pieces)	Catch (pounds)
Curtis	257,000	11,565	130,000	50,960	315,952
Kitlope	--[3]	--[3]	653,400	256,133	1,588,023
Sproat	13,335,000	333,375	--[4]	--[4]	--[4]
Long	1,840,000	46,000	884,100	486,255	3,027,910
Lowe	246,000	11,070	307,600	120,579	747,591
Hobiton	540,000	24,300	172,900	105,469	516,798
Kennedy	790,000	35,550	600,000	366,000	2,159,400
Great Central	11,924,000	536,580	1,797,000	1,096,170	5,371,233
Henderson	1,359,000	61,155	572,300	349,103	1,710,605
Awun	167,000	7,515	255,500	143,080	887,096
Eden	297,000	13,365			
Ian	272,000	12,240			
Devon	59,000	1,475	85,000	32,320	206,584
Bonilla	115,000	5,173	43,500	17,052	105,722
Woss	2,539,000	63,475	600,000	336,000	2,122,096
Nimpkish	12,758,000	318,950			

[1] 1982 juvenile releases are from the 1980 brood year stocks.

[2] When applied to lake enrichment, "at design capacity" refers to the carrying capacity of the lake.

[3] Insufficient samples taken to determine release and expected production figures for 1982.

[4] Capacity figures are not available.

Disease Control

Bacterial kidney disease (BKD) is an important and widespread systemic disease of salmonids, which, because of its chronic but progressive nature, is thought to cause the greatest losses in Pacific salmon that have left the hatchery and migrated to sea. The addition of antibiotics in the diet to control BKD has not proved effective, and so other methods of control including vaccination and egg disinfection were investigated.

Vaccination Studies

The vaccination of coho salmon against BKD utilized three different vaccines consisting respectively of killed, whole cells of causative pathogen, Renibacterium salmoninarum (RS) (3 dosages); sonically-disrupted RS cells; and RS extracellular products. All three vaccines failed to enhance levels of circulating RS agglutinins (antibodies) in the blood beyond the unexpectedly high levels already present in the unvaccinated control fish. Explanation for this apparent lack of response is not immediately obvious, as the vaccines should have acted as "booster" treatments.

Tests performed on the antibody-containing blood obtained from control and vaccinated coho proved these blood samples to be nonlethal for the pathogen, R. salmoninarum, thus ruling out the possibility of using blood samples as a rapid in vitro means of assessing the efficacy of vaccination. Instead, vaccination efficacy was determined by challenging the vaccinated coho with the live, slow-acting pathogen. The outcome of these challenge tests revealed that coho, like sockeye, do not appear to be protected against RS by vaccination.

Results to date suggest that members of the genus Oncorhynchus, unlike those of the genus Salmo, may be unable to benefit from vaccination against RS. Further extensive efforts to investigate anti-RS vaccines suitable for Pacific salmon therefore seem to be unwarranted.

Egg Disinfection Studies

The apparent inability of Pacific salmon to develop an effective immune response against BKD made it necessary to investigate other methods for control of the disease. Recent findings indicate that the pathogen is carried within the salmonid egg and suggest that this mode of transmission may be an important means by which the slow-growing pathogen maintains itself in salmonid populations. Therefore, control of BKD might be possible if the cycle of infection could be broken at the egg stage.

One practical method for reducing the likelihood of transmission of BKD in salmon eggs is to avoid using eggs from fish with a cloudy coelomic fluid. It was found that the eggs from such fish were likely to be infected internally as well as externally with RS. In addition, very recent results suggest that other bacteria present in high numbers in coelomic fluid may also be found in the eggs. Since these bacteria may include other known fish pathogens, such as Aeromonas salmonicida and A. hydrophila, the importance of avoiding the use of such eggs cannot be emphasized too strongly.

Attempts to develop an effective egg disinfection method were continued. Results indicated that RS occurred in the egg yolk rather than in the perivitelline space and that disinfection of water-hardened eggs with iodine (Ovadine), though effective at eliminating the pathogen on the egg surface, was completely ineffective on the intra-ovum pathogen. Iodine is a fast-acting, but relatively toxic disinfectant. However, when iodine is applied to uninfected eggs at levels up to 250 parts per million in the form of Ovadine for one hour during (rather than after) water-hardening, it failed to cause any increase in egg mortality or in fry malformation greater than that which occurred in eggs hardened in water only. These results contradicted published findings which discourage the use of iodine on eggs during water-hardening. The possibilities and benefits of using Ovadine as an antibacterial and antiviral agent to treat eggs during water-hardening will need to be investigated further, using infected eggs. To facilitate this study, a convenient source of infected eggs is needed. In 1983, efforts will be made to determine whether salmon eggs can be artificially infected at will.

Other work on egg disinfection resulted in the identification of several antibiotics with strong anti-RS activity. One of the most promising of these antibiotics, erythromycin, was absorbed by the eggs, and persisted in the eggs indefinitely following its injection into brood fish. The antibiotic also accumulated in bactericidal concentrations in the yolk when the eggs were incubated in the presence of erythromycin prior to or during water-hardening. However, once the water-hardened eggs containing the antibiotic were placed in antibiotic-free water, the intra-ovum antibiotic leached rapidly from the eggs. This finding was unexpected, since the vitelline membrane surrounding the yolk was thought to become sufficiently impermeable on water-hardening to result in retention of slow-acting antibiotics for periods long enough to ensure their effectiveness. The fact that the vitelline membrane remained permeable to antibiotics suggested, however, that it should be possible to treat eggs internally with antibiotics at any stage of their incubation. In tests with erythromycin, this proved to be the case. It now remains to be determined how long contact is required between a pathogen and antibiotic to bring about a bactericidal effect.

Contact: Dr. Trevor Evelyn, Research Scientist, Fisheries Research Branch, Pacific Biological Station, Nanaimo.

Diagnostic Service

The Diagnostic Service provides a comprehensive service for determining the cause of losses and disease outbreaks among cultured salmonids and advises fish culturists on appropriate control and preventive measures.

In most major SEP facilities, as well as at many smaller projects, salmon are reared in confined spaces at high densities. Fish culture under these conditions can lead to severe fish health problems and costly disease outbreaks if a watchful eye is not maintained.

In 1982, the Service investigated approximately 300 cases of fish health problems. Fortunately, improved enhancement techniques and more sensitive disease detection methods permitted healthy, high-quality smolts to be released in most cases.

The most serious problem investigated in 1982 involved losses among 1981 brood chinook fry. These fish developed normally for approximately 60 days after ponding, then abruptly stopped feeding, developed into emaciated pinheads and died, either from starvation or secondary infections of the gills. In some instances, losses reached 15 percent. Hatcheries in Oregon and Washington reported a similar, if not identical, problem. The exact cause remains unknown, but a dietary imbalance is strongly suspected.

Furunculosis remains the most common infectious disease among salmonids. The causative agent, Aeromonas salmonicida, has a wide distribution in British Columbia. Disease mapping activity by the Diagnostic Service has shown that all major coastal streams in the province contain the bacterium. By monitoring a single pond at the Quinsam River hatchery, it became apparent that the mechanism by which an outbreak is triggered is complex and involves more than simple stress.

In July 1982, the first recorded outbreak of ceratomyxosis, caused by the internal parasite, Ceratomyxa shasta, occurred among cultured juvenile chinook in the lower Fraser River. Losses were low, but clearly indicated that the presence of the organism in the Fraser River system must be taken into account when new enhancement sites are selected and developed. Until recent surveys by the Service revealed that this organism also occurs on Vancouver Island, the Queen Charlotte Islands and in the Yukon, its distribution in Canada was thought to be restricted to the Fraser system.

Contact: Gary Hoskins, Fish Health Biologist, Pacific Biological Station, Nanaimo.

Ceratomyxa Shasta Study

EVS Consultants Ltd. and Envirocon Ltd. are conducting a joint study of the infectiousness of Ceratomyxa shasta in Fraser River salmon stocks. This disease liquifies the internal organs of the fish. Although the detection of spores is the only way to confirm C. shasta as a causative agent, spores do not develop until the fish is near death. In addition, the spores themselves are not infectious. Little is known about the life cycle of C. shasta, but it is suspected that the organism has an intermediate stage and/or host between the spore and fish-infection stages.

The disease, for which there is no known treatment, has presented serious problems for U.S. hatcheries. Disease surveys of the adult fish of wild stocks in the Fraser River have demonstrated that C. shasta is widespread and present in both chinook and coho. Exposure of chinook fry to Fraser River water near Whonnock, with subsequent rearing of these fry in a laboratory setting has resulted in very high mortalities. Contrary to the U.S. results, upriver stocks of fry in the Fraser system are not resistant to the disease, and there does not appear to be a 'turn-off' period below 10°C (infections have been found to occur down to 3°C so far). Immediate removal to and rearing of exposed fry in salt water does not check the disease. Although these results give cause for concern, it seems unlikely that the present wild stocks suffer significant mortality from the disease, considering the high productivity attributed to Fraser River chinook. The results may therefore be an artifact of artificial rearing. Further study of the timing and distribution of the infectious stage of C. shasta is required, and tagging studies are planned to determine whether the disease is a serious problem for naturally migrating smolts.

Contact: Bruce Shepherd, New Projects Coordinator; Ted Perry, Biological Program Coordinator, Enhancement Operations; Gary Hoskins, Fish Disease Diagnostics, Pacific Biological Station, Nanaimo.

Controlled Reproduction

The objective of this program is to develop new methods and improve existing methods for the controlled reproduction of salmonids so as to facilitate stock enhancement, increase the landed value of the catch and provide new options for the management of the fishery. Also funded in this program is research on the effect of hatchery loading density on ocean survival.

Contact: Dr. Ed Donaldson, Research Scientist, Fisheries Research Branch, West Vancouver Laboratory.

Controlled Sex Differentiation

Major progress in the development of techniques for the control of sex differentiation in Pacific salmon was achieved in 1982. The purpose of this work is to develop ways to produce selectively all-female or sterile groups of Pacific salmon.

Enhanced production of females will result in an increased egg-take from a given escapement, a reduction in the incidence of jack salmon and an increased value of the catch where the roe is valued separately.

The production of sterile salmon smolts will delay or prevent sexual maturation and therefore, the return migration of adults. The result will be salmon that remain available to the fishery for a longer period of time while they grow to a larger size. The production of jacks will also be eliminated.

Further results from the May 1980 pilot release of all-female and sterile coho salmon from the Capilano salmon hatchery were obtained in 1982. As expected, the all-female group returned to the hatchery in late 1981, while the sterile group did not. Analysis of a subsample of the sterile group held in a net pen at the Pacific Biological Station in Nanaimo indicated that the sterile fish continued to grow throughout 1982. In December 1982, these pen-reared fish had a mean weight of 2.0 kilograms (largest 3.6 kg), compared to 1.2 kg (largest 1.6 kg) in

December 1981. Similar numbers of tags from sterile fish were recovered in the commercial (60) and recreational (70) fisheries during 1982. In the commercial fishery, the average length of sterile fish was 49 cm (estimated weight 2.8 kg) in September 1981, and this had increased to 61 cm (estimated weight 5.6 kg) by September 1982. In spring 1982, 80,000 Capilano coho were sterilized for a second pilot release in 1983.

In 1982, further research was conducted on the development of sex control techniques for chum salmon. In particular, this study is designed to produce sterile chum. In late 1982, a pilot experiment on sex control in chum salmon was initiated at the Thornton Creek hatchery near Ucluelet.

Also in 1982, a pilot study was initiated on chinook salmon at Capilano hatchery. The ultimate purpose of this study is to increase the proportion of female chinook in the escapement to the hatchery and thus increase the rate of stock enhancement of this species. The first step in this process is to convert normal female alevins and fry into males and release them into the ocean. When these fish return, they have the physical characteristics of males but produce "female" milt which, when used to fertilize normal eggs, will result in all-female offspring.

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Laboratory.

Induced Ovulation and Spermiation

Suboptimal adult-holding conditions in fresh water or sea water can result in different maturation rates for male and female salmonids, prespawning mortality or failure to spawn at the optimal time for enhancement purposes. In this project, techniques are being developed to regulate the time of final maturation and ovulation in females and spermiation in males. In fall 1982, ovulation tests were conducted using the newly isolated salmon gonadotropin-releasing hormone and potent analogues derived from it. As expected, the natural gonadotropin-releasing hormone (GnRH) did induce ovulation in a proportion of the fish; however, potent analogues were even more effective in inducing ovulation. The induced ovulation technique using a GnRH analogue has found immediate acceptance among commercial salmon culturists and has had a dramatic effect on egg-takes from both captive and sea-ranched brood stocks.

Contact: Dr. Ed Donaldson, Research
Scientist; George Hunter,
Biologist; Glen
Van Der Kraak, Biologist,
Fisheries Research Branch,
West Vancouver Laboratory.

Maturation of Chum Salmon Held in Salt or Fresh Water

For the large-scale propagation of chum salmon, holding of adults in net pens in salt water has many advantages over the capture of brood stock on their spawning grounds. Some problems encountered during seawater holding, however, are increased prespawning mortality and poor viability of the eggs and sperm.

In 1981, it was established that eggs had low fertility when they were collected from females which failed to osmoregulate efficiently. The intentional exposure of fish to handling stress caused a breakdown of osmoregulation.

When either salmon gonadotropin-releasing hormone or an analogue is injected, the maturation process could be accelerated so that prespawning mortality was eliminated. Furthermore, the fertility of eggs and sperm can be high, regardless of the environmental salinity. Studies still in progress will show whether factors such as sex hormone concentrations or mineral concentrations in blood and sex cells differ between fish maturing in fresh water and sea water.

Contact: Dr. Joachim Stoss and Ulf Fagerlund, Research Scientists, Fisheries Research Branch, West Vancouver Laboratory.

Triploidy and Gynogenesis in Salmonids

In a study in 1981, 75 percent of a group of treated coho salmon were discovered to be triploid fish. These fish possess one extra set of chromosomes, whereas normal diploid fish possess the normal complement of chromosomes. These fish were tagged individually to enable the comparison of growth and sexual development in triploid versus diploid fish. At least half of these triploid fish are expected to be sterile. If they show growth comparable to the normal diploid coho, the induction of triploidy can provide a useful means of sterilization.

Gynogenetic [all-female] pink salmon, which have been subjected to a masculinization procedure, are presently being reared and will reach sexual maturity in the fall of 1983. The sperm of these fish will result in all-female offspring when used to fertilize normal eggs.

Contact: Dr. Joachim Stoss, Research Scientist, Fisheries Research Branch, West Vancouver Laboratory.

Salmon Genetics

Genetic variability and the effect of hatchery production on five populations of chum salmon that spawn in streams around Tlupana Inlet on the west coast of Vancouver Island, have been investigated since 1981. Gene frequencies in the five natural populations will be quantified before chum returns from hatchery production begin. Conuma River hatchery on Tlupana Inlet, rears the progeny of parents taken from the five spawning populations and then releases the progeny from each population back into their natal stream the following spring. Consequently, a fraction of the returning adults from each brood year will have experienced a hatchery environment and may therefore influence the gene frequencies of recipient populations. This project will monitor the gene frequencies in the five populations over three to five generations in order to detect any significant changes in gene frequencies.

During 1982, tissue samples obtained from fry and adult chum salmon of each natural and hatchery population were analyzed electrophoretically. Gene frequencies are consistent between adults collected annually within each population, but gene frequencies vary between populations of adults and sometimes vary between fry and adults within a population. Gene frequencies identified from chum fry are sensitive to sampling error as indicated by a significant variation between replicate fry samples collected within populations during 1982. Random sampling error in fry samples may account for the differences obtained between fry and adult samples and indicates the need for large, well-randomized samples when collecting chum fry for the purpose of defining gene frequencies of a population. In 1983, sampling of fry and adults will be repeated, and intensive sampling of the escapement will be undertaken to determine the incidence of straying of hatchery progeny.

In 1982, the Salmonid Enhancement Program (SEP) helped to fund the construction of new facilities at the Rosewall Creek experimental hatchery. A new building will house 156 new tanks and will increase the hatchery's experimental capacity to 240 tanks. These new facilities will permit investigations of the polygenetic variation between natural fish populations, the genetic consequences of hatchery practices and selective breeding of salmonids.

Contact: Dr. Brian Riddell, Research Scientist; Ruth Withler, Biologist, Fisheries Research Branch, Pacific Biological Station, Nanaimo.

Fish Nutrition/ Smolt Quality Program

During 1982, studies on fish nutrition were directed to:

-optimize the morphological and biochemical characteristics of hatchery-reared salmonids before release to enhance their ocean survival

-develop practical salmonid diets using Canadian ingredients

-reduce the susceptibility of hatchery-reared salmonids to noninfectious diseases by nutritional means

-establish the local manufacture of fish food under strict quality control.

The reasons for pursuing each of these goals include evidence which suggests that the body composition of hatchery-reared smolts influences their subsequent ocean survival, independent of an effect of size and time of release. Also, present salmon feed costs are inflated due to the use of imported semimoist food, and some nutrients, such as vitamins and minerals, may be well in excess of requirements. Suboptimal dietary levels and/or balance of nutrients may also induce noninfectious diseases, such as bilateral lens cataract. The local manufacture of fish food, rather than importing all food as is currently practiced, will ensure better control over the quality of ingredients and finished diet. As well, control over production times and deliveries will permit the rapid manufacture of specialty and medicated foods.

Major accomplishments in the study of fish nutrition include the following items. First, preliminary return data for 1978 brood chinook fed dry diets produced by West Vancouver labs, or Oregon Moist Pellets (OMP), during freshwater residency at Robertson Creek hatchery indicated that the return rates for chinook fed dry diets were about twice that of chinook fed the OMP diet. Returns of 1979 brood chinook jacks suggested the body composition of hatchery-reared chinook should be similar to that of wild stocks to enhance their ocean survival. Second, canola oil and pork lard, singly, or in combination, were noted to be excellent supplemental dietary lipid sources for juvenile chinook salmon when compared to herring oil. Previous nutritional history in fresh water had little, if any, effect on chinook survival in sea water. Third, chinook smolts of similar size but of significantly different fatty acid composition were released simultaneously from Robertson Creek hatchery into the ocean. All groups were distinctively tagged prior to release. Also, the growth and survival of pink salmon were significantly enhanced by feeding these fish dry or moist diets of high nutritional value and by the early transfer of pinks (within 48 hours after swim-up) into sea water. At Quinsam hatchery, the growth and survival of juvenile coho salmon fed the West Vancouver 1 (WV1) dry diet have been similar to that of coho fed the OMP diet except at the fry stage, where the OMP diet was superior. At Qualicum hatchery, a preliminary study indicated that chinook fed the OMP diet survived better than those fed the WV32 dry diet at low water temperatures (<8°C). At West Vancouver labs, it was noted that the growth, food conversion, survival and cataract incidence in juvenile chinook salmon were dramatically influenced by varying the concentrations of calcium, zinc and phytic acid (a mineral chelating agent present in plant proteins) in their diet. Finally, a comprehensive quality control program for fish diets was instituted in 1982, and significant progress has been made toward establishing the local manufacture of fish food by the end of 1983 or in 1984.

Contact: Dr. Dave Higgs, Research Scientist, Fisheries Research Branch, West Vancouver Laboratory.

Smolting Requirements

This research traces the ability of juvenile salmon to adapt to sea water as influenced by their rearing environment, size, and time of release. The purpose of this study is to determine optimal rearing conditions for juvenile salmon and to evaluate a 24-hour seawater challenge test as an index of marine survival.

A laboratory feeding study with juvenile coho salmon was completed in July 1982. The results indicated that it is possible to produce coho smolts of the desired size for release either by adjusting the amount of food presented or by altering the feeding frequency.

Another laboratory study was conducted from January until August 1982 to examine the growth and seawater adaptation of juvenile red and white (flesh) chinook from the Quesnel River hatchery. Early growth was similar for both groups, but the red-flesh fry grew faster from May to August. The white chinook fry differed from the red stock in their greater ability to adapt to sea water in March and also showed a decreased ability to adapt to sea water during the summer.

During the spring and early summer of 1982, regular seawater challenge tests were conducted using juvenile coho from a time and size-at-release experiment at Capilano hatchery (Vancouver) and chinook from a similar experiment at Quinsam hatchery in Campbell River. The results will be compared with the rate of adult returns in each of the release groups in order to evaluate the seawater challenge test as an index of marine survival. In 1983, samples of sockeye smolts migrating from Great Central Lake will be subjected to seawater challenge tests in order to determine the relationship between size and ability to adapt to salt water.

Contact: Dr. W. Craig Clarke, Research Scientist, Fisheries Research Branch, Pacific Biological Station, Nanaimo.

Stress and Histophysiology

The objective of this program is to determine whether the ponding density of juvenile coho and chinook salmon reared in the hatchery influences the ocean survival or the rate of return of the adults. Initially, these studies were carried out at Capilano hatchery, a coldwater system, with coho smolt releases in 1977, 1979, and 1980 and chinook releases in 1980 and 1981. To permit comparisons between a cold and warmwater hatchery system, additional studies will be initiated with coho at Quinsam hatchery, with the first smolt release expected in May 1983.

a) Capilano hatchery studies

Results from the 1977 and 1979 coho releases from Capilano hatchery showed a strong negative correlation between numbers of returning adults and the ponding density of juveniles. On the other hand, there were only small differences in the rate of adult returns from smolts released in 1980, when ponding densities ranged from 49,474 to 91,875 fish per pond. The size of coho smolts--when subpopulations of small, medium, and large fish within each pond were marked with distinctive tags--showed a positive correlation with return rate of adults. One possible reason for the lack of correlation between adult returns and ponding density in the most recent study may be the fact that ponding at the various densities did not occur until after the fish had reached an average weight of 9 to 12.5 g, while in the two earlier studies, ponding occurred when the fish weighed between 1.5 and 3 grams.

b) Quinsam hatchery studies

In May 1982, coho fry were placed in four ponds at initial densities of 73,000 to 121,000 fish per pond. To determine how smolt size within each pond affects the rate of adult returns, subpopulations of small, medium, and large fish were identified with distinctive coded-wire tags. These fish will be released in May 1983.

Contact: Jack McBride and Ulf
Fagerlund, Research
Scientists, Fisheries
Research Branch, West
Vancouver Laboratory.

Incubation and Water Quality

The main objectives of this research are to develop water quality standards, primarily for egg incubation, and to improve and standardize certain techniques, from egg and milt collection to the first feeding of fry, used in salmonid hatcheries.

Contact: Dr. Don Alderdice, Research
Scientist, Fisheries Research
Branch, Pacific Biological
Station, Nanaimo.

Mechanical Shock

An investigation of the effects of mechanical shock on coho eggs will be published in 1983. Data are now available on the sensitivity of steelhead trout eggs to shock. Sensitivity to shock follows a course similar to that found for coho eggs. A similar study for chinook eggs is scheduled for 1983.

Contact: John Jensen, Biologist,
Fisheries Research Branch,
Pacific Biological Station,
Nanaimo.

Short-term Storage of Chum Salmon Gametes

Chum salmon gametes were stored at temperatures of 3°C to 15°C for periods up to 460 hours. Estimates of time to 50% and 90% fertilization success (FS) were obtained for stored eggs, stored milt, or stored eggs and milt. Times to 90 percent FS ranged from 19.6 hours at 15°C to 123.9 hours at 3°C. The loss of fertilization success was additive when both gametes were stored. Stored eggs were characterized by a slow but steady rate of loss of ability to be fertilized. In contrast, stored milt retained an initially higher fertilization potential followed by a rapid loss of this potential. Results showed that increased viability of stored gametes should be attainable under field conditions at a storage temperature of 3-5°C, by maintaining gamete-to-air ratios in storage containers of not less than 1:1 for eggs or 1:30 for milt, and by maximizing the interface area between air and gametes in the storage container (for example, by laying plastic bags of milt on their sides). Other studies have shown that further increases in storage time can be obtained by replacing the air in the closed containers with oxygen.

Contact: John Jensen, Biologist,
Fisheries Research Branch,
Pacific Biological Station,
Nanaimo.

Low Viability of Chum Salmon Gametes, Deserted River (Conuma Hatchery) Egg-Take

The results of this study, and those of concurrent work carried out elsewhere, indicate that the holding of adult chum salmon in sea water can lead to low viability of collected gametes. The final stages of sexual maturation appear to be concurrent with loss of ability of adults to osmoregulate in sea water (25‰ or greater in this study). The presence of a lens of less saline water on the surface in the holding pens was associated with reduced prespawning mortality and higher egg viability. In general, blood plasma ion levels and osmolality are higher in adults held in sea water compared with those held in fresh water. The higher blood ion levels and osmolality of seawater-held adults are correlated with similar high levels in the ovarian fluid and milt plasma. Finally, it appears that if mature adults are held for a further period in sea water, there is an ultimate rise in ovarian fluid ion levels coincident with a reduction in egg viability. If sea pens are loaded over a period of time with maturing adults, a mixture of premature, mature and postmature individuals is likely to result, with mortality occurring first among postmature individuals. Considerable variability in the viability of eggs ultimately collected is therefore likely.

Contact: Charles Lam, Biologist,
Fisheries Research Branch,
Pacific Biological Station,
Nanaimo.

Other SEP-Funded Research Projects

Other projects being initiated, in progress or being completed include:

- definition of critical dissolved oxygen levels for the successful incubation and culture of Pacific salmon and steelhead trout eggs and alevins. To be completed in 1983.
- determination of the effects of variations in levels of total gas pressure (nitrogen and oxygen) on the development and survival of salmonid eggs and alevins. To be reported during 1983.
- determination of the effects of various levels of dissolved oxygen and unionized ammonia on the development and survival of salmonid eggs and alevins. To be reported during 1983.
- determination of factors associated with coagulated yolk syndrome in salmonid eggs. Continuing.
- experimental optimization of keeper pond parameters in B.C. Japanese-style hatcheries. New project under development.

Contact: Peter Rombough, John Jensen,
Charles Lam, Biologists;
Fisheries Research Branch,
Pacific Biological Station,
Nanaimo.

FRB-Funded Projects, SEP Problems

- determination of the hydrostatic pressure in salmonid eggs. A method has been developed for measuring the turgor pressure inside salmonid eggs. This technique provides a new approach to the examination of certain biological problems that occur during egg incubation. To be reported in 1983.

- tolerance of Pacific salmon eggs and alevins to low environmental pH. Alevins are more sensitive to low pH ("acid rain") than are incubating eggs. In decreasing order, the sensitivity of alevins to low pH is: chum, pink, sockeye, chinook, coho. Abnormal behaviour in pink and chum alevins was noted at pH 6.0-6.1. In chum alevins, 10 percent mortality in a 10-day exposure period occurred at a pH of 5.74. To be reported in 1983.

- fine structure of the salmonid egg capsule. A description of the structure of the Pacific salmon and steelhead egg capsule has been completed using the electron microscope. The results relate directly to the dissolved oxygen requirements of eggs and to the influence of hydrostatic pressure on egg development.

- data on the effect of temperature on salmonid egg development are now complete for Pacific salmon and steelhead trout. Analysis should provide time-temperature relations, from fertilization to hatch, the upper and lower lethal temperatures for egg development, and the optimum temperature range for egg survival to hatch.

- a review of heavy metals and their toxicity to salmonids was completed, and the influence of copper, zinc, and cadmium concentrations was assessed using Campbell River and Quinsam hatchery juvenile salmonids. Heavy metal loads in the Campbell River were assessed as being critical during 1980 and 1981. A reduction in heavy metal concentrations began in late summer 1981, and appears to be continuing.

Contact: Dr. Don Alderdice, Research Scientist; Peter Rombough, Biologist; Eric Groot, Biologist; Frank Velsen, Research Technician, Fisheries Research Branch, Pacific Biological Station, Nanaimo.

Hatchery Water Quality Criteria

Mr. L. Fidler was contracted by SEP in 1982 to review and write a report on aeration theory in order to determine the limiting factors and thus suggest possible ways in which aeration efficiency might be improved.

Sigma Resource Consultants Ltd. undertook to review and update their report, Summary of Water Quality Criteria for Salmonid Hatcheries. It was felt that significant knowledge had accumulated since its first publication in 1979, particularly for factors such as temperature, dissolved gases, metals, nitrite, and ammonia, chlorine, suspended solids, and their interactions with factors such as pH and water hardness. Both of these reports should be available by mid-1983.

To improve predictive capability for new projects, coastwide data on the thermal requirements (accumulated thermal units) to reach the eyed, hatch, and swim-up stages in the salmonid life cycle were compiled and analysed by species and geographic location. A draft report and a set of predictive tables are available, with the results summarized in Info Memo No. 45.

Contact: Bruce Shepherd, New Projects Coordinator; Bill McLean, Operations Support Biologist, Enhancement Operations.

Chum Incubation Requirements

The chum incubation program was comprised of three main activities in 1982.

A pilot Japanese-style chum hatchery (JSH) was operated from 1976 to 1981 on Rosewall Creek located on the east coast of Vancouver Island. One objective of this study was to compare JSH-produced chum fry with fry produced in deep-gravel incubators (box) primarily in terms of survival to the adult stage. In each of three successive years, between 250,000 and 500,000 chum fry from each source were released with a double fin clip. Adult returns recovered up to 1982, and allocated provisionally to source and year-class on the basis of marks and age, are shown in Table 46.

Three main conclusions were drawn from this study. Chum of both treatments survived poorly to the adult stage. The JSH-chum outperformed the chum produced in incubators by a ratio of about 40 to 1 overall. In addition, JSH-fish tended to return earlier than did the fish produced in boxes. When the three brood years are combined, the shift in age of return is highly significant (X^2 = 47.05, df = 2, P = 0.00001). The result, however, was not consistent between years. If the 1977 brood year is omitted, no such shift in age of return is observed (X^2 = 1.271, df = 2, P = 0.47, NS). The phenomenon may therefore occur only under certain conditions of food supply and mortality. Results cannot be attributed to the method of incubation alone. Unrelated factors associated with fin-marking and release procedures clouded the results. No differences between treatments were observed in timing and size at the same age of return.

In 1982, two publications were completed on JSH-optimization experiments completed in 1981. The first discusses the effects of three different fish densities, two flow rates, and two

Table 46

Adult Returns From JSH and Incubators

Brood Year	No. Fish	Source	3-year-olds		4-year-olds		5-year-olds		Totals	
			No.	%	No.	%	No.	%	No.	%
1976	253,000	JSH	367	0.15	845	0.33	64	0.025	1,276	0.51
	392,000	Box	0	0	28	0.007	2	0.001	30	0.008
1977	498,000	JSH	1,997	0.40	666	0.13	22	0.004	2,685	0.539
	505,000	Box	17	0.003	29	0.005	9	0.002	55	0.011
1978	396,000	JSH	121	0.031	320	0.081	0	0	441	0.111
	422,000	Box	22	0.005	10	0.002	0	0	32	0.008
Total	1,147,000	JSH	2,485	0.217	1,831	0.160	86	0.007	4,402	0.384
	1,319,000	Box	39	0.003	67	0.005	11	0.001	117	0.009

gravel depths on survival, size, and time of emergence of JSH and box-incubated chum. The second paper discusses growth rates and sizes attained during the eight weeks following emergence for the different groups of chum fry produced in these incubation experiments.

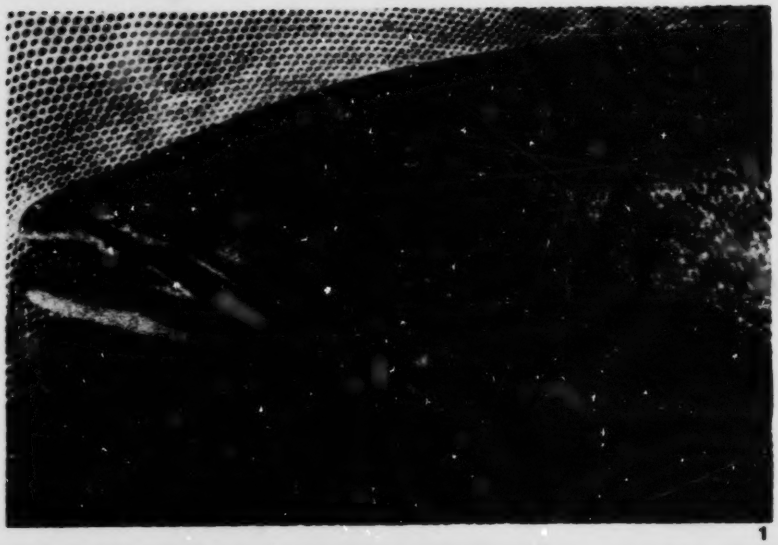
In 1982, data analysis is continuing for investigations into the incubation of chum at Rosewall hatchery (1977/79), coho at the Big Qualicum project (1978/80), and sockeye at the Fulton River channel (1975/77).

Contact: Dr. Rob Bams, Research Scientist, Dennis Crabtree, Technician, Fisheries Research Branch, Pacific Biological Station, Nanaimo.

Side Channel Rearing of Steelhead Trout

Work on the assessment of a river side channel for rearing salmonids was completed in 1982. Its purpose was to compare the annual yield of steelhead smolts from a seminatural side channel with that of the parent river. Two trials were completed in the Big Qualicum experimental rearing channel. In the first trial (Oct. 1980-June 1981), 10,000 steelhead fry were introduced to the channel which was maintained at a flow discharge of 0.42 m^3/second. The steelhead fry, however, were largely displaced by wild coho and were unable to withstand the water velocity in winter. The numbers of steelhead fry were also greatly reduced by infection with Cryptobia. In the second trial (Oct. 1981-June 1982), flow discharge was reduced to 0.14 m^3/second, more acceptable to steelhead fry. The yield of steelhead smolts, of mean weight 14.5 g, was 1,200, and 3,048 parr remained in the channel. Numerically, the smolt yield per unit area was 31 times greater than that of the river. In terms of fish biomass, it was 10 times greater. Channel discharge was 2.6 percent of the river discharge. A paper which includes a discussion of the factors that determine smolt yield from streams has been prepared.

Contact: Dr. Harold Mundie, Research Scientist, Fisheries Research Branch, Pacific Biological Station, Nanaimo.



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Provincial Research

1. The provincial Fish and Wildlife Branch's responsibilities in SEP are related to steelhead (1) and sea-run cutthroat (2) enhancement.

3. Habitat improvements, such as these spawning platforms on the Nicola River system are an important component of steelhead enhancement and research.

Provincial Research

Headwater Stocking

Hatchery-produced steelhead smolts are used to augment wild steelhead populations. However, because of the high cost of hatchery production and the various effects that hatchery fish may have on wild populations, alternate ways to enhance wild populations are being examined.

Utilizing rearing areas above obstructions is one potential method of enhancing wild steelhead stocks. The objectives of this research program are to assess the biological and economical feasibility of stocking steelhead fry in headwater areas.

In 1982, the fifth year of this project, two major experiments were conducted. The first experiment in Lynn Creek involved a study of the effects of release density and stock origin on fish growth and survival. The second, in the Englishman River system on Vancouver Island, looked at the effects of time and size at release.

Final data collection was conducted on Lynn Creek in the spring and summer of 1982. A smolt-trapping operation was conducted below the falls for two months in the spring, followed by an electroshocking census in the stocking area above the falls. This procedure permitted accurate survival estimates to be made. An electroshocking census was also conducted on the Englishman River.

As this project is nearing completion, the data analysis techniques were reviewed, and in some cases revised, to provide more accurate estimates. Final data anelysis is mostly complete for Lynn Creek, but only partially done for the Englishman system.

Overall survival and growth of Lynn Creek steelhead decreased as stocking density increased, although there may be little effect of density at levels below 0.5 fry/m^2. The numbers of smolts counted that were more than two years old were disappointingly low at 1.4 percent, 0.9 percent and 0.4 percent of release for the low, medium and high density releases respectively. This may be due to a severe flood in the fall of 1981 which altered the course of the creek in many locations. No consistent differences in the growth or survival of Lynn Creek and Big Qualicum River stocks released in Lynn Creek have been found.

Replicate fry releases were done on the Englishman River and its tributary, Moriarty Creek, in 1980 and 1981 at various times, from late May to early October, and at various release sizes ranging from 0.2 g to 15 grams. Final interpretation must wait until the analysis is complete, but in the 1980 brood, the 2 g and 6 g releases appeared to have the best survival rates, while few differences have been found in the 1981 brood year.

In 1983, a smolt trap will be operated on the Englishman system to monitor the experimental releases and production releases of fry and parr in the headwaters.

Contact: Jeremy Hume, Fisheries
Biologist, Fish and Wildlife
Branch, Vancouver.

Keogh Pilot for Steelhead Enhancement

Steelhead fishery managers need more information to effectively regulate these fisheries in British Columbia, particularly in coastal regions, to prevent overfishing and to optimize smolt production and adult returns. Simultaneously, there is a continuing need for the development, refinement and evaluation of cost-effective techniques for enhancing and restoring stocks of steelhead trout and other anadromous fish. Research and development projects on the Keogh River on northern Vancouver Island were initiated in 1976/77 and designed to:

- develop a predictive model for estimating the production capability of steelhead streams
- assess the harvestable surplus or sustained yield of steelhead in a typical coastal river
- examine the feasibility, constraints, and cost-effectiveness of several enhancement techniques.

Keogh Steelhead Evaluation

Production capacities and age-specific survival rates are assessed to assist in regulating annual harvest levels of fish stocks, and they have been intensively studied on the Keogh River from 1976 to 1982. A related purpose for these juvenile studies was to determine the significance, possible causes and impacts of "residuals" (released "hatchery" smolts that fail to migrate and become resident). Commencing in 1982, the project also began evaluation of the returns of various groups of smolts reared at different densities in net pens at O'Connor Lake.

a) Wild Steelhead Survival and Production

A preliminary model was completed that predicts the density of steelhead parr, smolt yield and adult populations as an average of habitat capability. Some refinement is required, particularly to provide an adjustment where stream width is greater than 20 meters. The model will be reported in technical report format.

Sufficient data on fry densities and subsequent smolt yield were obtained to define a relationship. A minimum level or threshold of 0.2 fry/m^2 (July) appears to be necessary to fully saturate streams that are similar in productivity to the Keogh River. However, a more optimum target would be about twice this level, owing to uncertainty in obtaining adequate survival in both the egg-to-fry and fry-to-parr stages. High annual variations in age-specific survivals suggest that there would be considerable uncertainty in describing stock recruitment relationships even after several additional years of data collection.

b) Residualism

Residualism (or failure to migrate) of steelhead smolts, cultured in net pens within O'Connor Lake in the Keogh system, has been examined for three years. It has been demonstrated that residuals do not contribute significantly as out-migrating smolts in a subsequent year, but rather become resident trout which are highly biased in favor of males (3:1). The range of percent residualism in two years was 7 percent to 32 percent and increased in 1982, to approximately 50 percent for a group of 6,000 smolts. The latter group was released at the same size and time as an earlier group (7 percent residualism), but the stocking site in 1982 was 11 km from the ocean, versus 1.5 km in earlier years. A second group, stocked in 1982 at a site 0.3 km from the ocean, was similar in residualism to the earlier releases (about 10 to 20 percent).

Residuals were found in habitat similar to that of wild steelhead parr. They were equivalent in density to wild smolts and four times the latter in standing crop within 2 km of the stocking site. Until further evidence becomes available, the implication is that "up-river" releases of hatchery steelhead smolts should be avoided in smaller rivers managed for both wild and hatchery steelhead because residuals greatly exceed the natural carrying capacity of the stream and contribute to lower rates of returning adults.

c) Survival of Wild and Cultured Smolts

Three years of returns of "wild" smolts as 2-ocean and 3-ocean fish indicate a mean survival of 12 percent with a range of 8 to 15 percent. Proportions of 2-ocean, 3-ocean and repeat spawners have fluctuated greatly from year to year. By comparison, the survival of a pilot group of net pen reared smolts was 5.2 percent, and 3.2 percent for the 2-ocean component of a second larger (1980) set of releases (3-ocean fish return in the 1982/83 season).

Lake Pen Rearing of Steelhead Smolts

There have been few attempts to develop net pen culture in lakes for salmonids, although there are several advantages over conventional hatchery production, including much lower capital costs and possibly higher survival rates of these smolts in the ocean. Research and development of net pen culture of steelhead smolts at O'Connor Lake in the Keogh system was designed to:

- determine if fish could be reared consistently to an average release weight of 60 g
- resolve and refine operational aspects, including problems associated with ice formation, predation, high temperatures and early rearing
- determine the effects of rearing density on juvenile growth, smolt quality and returns of adults
- assist in the assessment of survival to adults for various groups of smolts stocked at various locations.

During 1982, 31,000 Keogh River steelhead smolts were produced and stocked at four stocking locations in the Keogh River. An additional site was located 4 km offshore in the ocean, after pre-conditioning smolts for four days to water near the mouth of the Keogh River. An additional 12,000 Tsitika River steelhead were reared in O'Connor Lake and successfully released into the Campbell River to establish a summer run.

During 1982, production of both Keogh and Tsitika steelhead stocks fell short of targets owing to higher than expected mortality in the egg stage (Tsitika stock) at Nanoose Station and in the fingerling stage (Keogh stock) in the O'Connor Lake hatchery. Projected releases for spring 1983, are 25,000 Keogh smolts to replicate the 1982 experimental stocking sites, and 18,000 Tsitika smolts for Campbell River.

Evaluations of pen-reared fish returning as adults to the Keogh River indicate a survival rate of at least 5 percent for fish that are transported and stocked in the lower river then rehandled at a counting fence located 1.5 km downstream.

Stream Enrichment

Research conducted in 1981 to evaluate food chain responses to inorganic and organic enrichment on the Keogh River indicated that inorganic fertilizers have greater potential for salmonid food chain enhancement. In developing the fertilization technique, however, two important questions needed to be investigated:

- at what level of enrichment does phosphorous limitation cease? This is important in providing information on the rates of enrichment which enhance periphyton activity yet inhibit uncontrolled exponential growth
- what is the long-term fish response in juvenile survival and growth rates over several years, smolting age, smolt yield and eventually adult returns, including cost-effectiveness?

Experiments in 1982 dealt specifically with the first of these questions and involved two sets of experiments. The first involved continuous nitrogen and phosphorous introductions at controlled rates to small troughs having constant water depth, flow, light and temperature conditions. Styrofoam substrates were placed in each trough and for the one-month duration of the experiment, substrate samples were collected for measurements of periphyton growth rate and alkaline phosphatase activity. The trough facility was established at Blaney Creek in the University of British Columbia Research Forest. In a cooperative effort with the National Water Research Institute, the design, construction and testing of trough hardware continued over four months, and, twelve troughs were subsequently maintained in a one-month experiment. This allowed treatments to be tested concurrently to identify growth responses to a wide range of nitrogen and phosphorous combinations. Results indicated that nitrogen additions in combination with constant high levels of phosphorous (> 10 μ g/L) were not significant in altering growth rates or community composition. Phosphorous additions (up to 10 μ g/L), however, resulted in highly significant changes, particularly in alkaline phosphatase activity. Additions of phosphorous at levels greater than 10 μ g/L did not further increase periphyton activity, indicating that growth was no longer limited by phosphorous concentration. Community composition was not altered by phosphorous additions. These data have been invaluable in developing the fertilizer treatment rate for a larger scale, river fertilization in 1983.

Concurrent with the trough experiment, short-term tests were conducted in temperature-controlled flow-through troughs at the Fraser Valley trout hatchery to examine nitrogen and phosphorous release rates from Osmocote® fertilizer. Osmocote® is a pellet-coating material which is applied in various thicknesses and is capable of regulating the dissolution of the encapsulated fertilizer to exact rate specifications. This work was conducted over an eight-month period and resulted in specific release rates to be determined for 0-45-0 and 26-0-0 fertilizers over a range of one to eight months.

The completion of this 1982 work has provided all necessary technical data for the application of an enrichment experiment using 0-45-0 and 26-0-0 Osmocote® to an entire river. This phase of the stream enrichment study will begin on the Keogh River in spring 1983.

Contact: Pat Slaney, Research Biologist; Chris Perrin, Research Biologist; Bruce Ward, Research Technician; Bill Harrower, Research Technician; Fish and Wildlife Branch, Vancouver.

Disease Diagnostics

The health of wild adults obtained from many different river systems must be determined in order to reduce the risks of transferring and disseminating diseases which jeopardize the health of the progeny. Steelhead, chinook, and cutthroat trout adults are collected and spawned. The eggs are hatched and the fry reared at various hatcheries and rearing sites prior to release as fry or yearlings. The importation of a disease agent into the water supply of a facility could result in high losses. In 1982, the Disease Diagnostics Section surveyed the following fish stocks.

Species	No. River Systems	No. Adults Examined
Cutthroat	7	82
Steelhead	20	330
Chinook	1	28
Brown Trout	1	90

The outbreak of bacterial kidney disease (BKD) which occurred in six-month old steelhead fingerlings at Loon Creek hatchery in November 1981 was monitored until May 1982. All mortalities were examined for the presence or absence of BKD. Two oral treatments of all three circular ponds and a third treatment of one pond with an antibiotic, erythromycin, did not seem to change the incidence of the disease. A thorough hatchery disinfection with a chlorine-based antibacterial solution was carried out at the facility immediately after the liberation of all chinook and steelhead stocks cultured over the past year. The source of the bacteria was suspected to have been the water supply from Loon Creek. The warmer surface water was mixed with spring water to help increase the growth rate of the fish. In 1983, only spring water will be used.

During the fall 1982, there was a severe outbreak of bacterial gill disease at the earthen rearing ponds in Surrey. The fish were netted into the top half of the ponds and potassium permanganate was metered in to produce a concentration of 1-2 ppm for 1/2 to 1 hour. Several treatments, with the help of decreasing water temperatures, were necessary before success was achieved. Cause of the outbreak was probably due to a water quality problem associated with the well water supply. Improvements in water quality and the therapeutic treatment of the fish resulted in eradication of the causative bacteria. Therapeutic techniques normally used are difficult in these situations due to the slow exchange rate of water in the earthen rearing ponds and the organic matter in such ponds which ties up an unknown amount of the treatment chemicals.

During the winter, Aeromonas salmonicida caused adult mortalities in wild brood stock held at the Vancouver Island hatchery in Duncan. Most of the mortalities occurred in Heber River steelhead stocks, but the Tsitika River steelhead and Nanaimo River cutthroat stocks were also affected. The unusually high seasonal temperature (13°C), combined with the handling of the fish probably promoted the disease when disease agents were present. The injection of oxytetracycline into the dorsal sinus of all stocks involved was successful.

Prior to their release, 77,000 cutthroat fingerlings were injected with a laboratory produced Vibrio vaccine.

The sensitivity of virus assays has been increased using preformed cell monolayers and more sensitive cell cultures. It is strongly recommended that tissue samples not be frozen, but be kept on ice and processed within 48 hours.

Due to the unusually high temperature of the well water at the time of adult steelhead collections at the Vancouver Island hatchery and the mortalities which occurred as a result of furunculosis this year, it is recommended that all brood stock taken into this facility in the future be started on an oxytetracycline treatment program. It should not be necessary to inject the adults more than twice, with a 10-day interval between treatments.

It will be important to monitor the health of the young fish at all facilities in the coming year. Special attention should be given to Vancouver Island hatchery because of the outbreak of furunculosis in ripe adults, and to satellite sites such as net pens and pond operations because of the past problems with bacterial gill disease.

Disease diagnostic services of a continuing nature are an essential part of the present enhancement program. Early detection of disease agents and related problems can result in the development of procedures necessary for ensuring healthy fish for the restocking program.

Contact: Beth Lindvik, Acting Fish
Health Biologist, Fish
Culture Section, Fish and
Wildlife Branch, c/o Pacific
Biological Station, Nanaimo.

Instream Habitat Enhancement

Boulder Placements

The streams selected were Scott Creek, a tributary to the Coquitlam River; Bear Creek, a tributary to the Serpentine River; and Springer Creek, a tributary to the Salmon River, near Kelsey Bay on Vancouver Island. In 1981, a post-treatment assessment of boulder placements indicated that, although there was a general trend of higher densities of trout and/or salmon in improved areas relative to control areas of the streams, at most sites these apparent increases were disappointingly small. Major shortcomings in the 1980 work appeared to have been lack of durability due to small rock size (mostly < 0.3 m); lack of complexity in placements (excessive spacing between rocks), and treatment of inappropriate areas in the streams. Therefore, boulder placement activities in 1981 were modified to try to correct the inadequacies. Only the most suitable areas in each stream were treated. The 1980 project sections in Bear Creek (800 m) and Springer Creek (450 m) had shown the most promising post-treatment results and, therefore, were treated again or augmented in 1981. A 500 m project section in Scott Creek was the only new site treated in 1981. Larger boulders (mean size was 0.6 m) were used to form clusters and were arranged with a variety of spacings consistent with habitat in nature. Smaller rock delivered with the larger boulders was used to form a foundation on which the larger boulders were perched to maximize habitat complexity and perhaps durability.

In 1982, physical and biological assessment of the 1981 boulder placements in Scott and Bear Creeks was conducted in July (about one month later than the timing of post-treatment assessment in 1981). The physical evaluation was based on visual observations at each site and included factors such as treatment durability, infilling and burial. The biological assessment was based on electrofishing captures at "treated" sites (those with boulder clusters) compared to control site. In Scott and Bear Creeks, three discrete treated sites (each with a corresponding control site) were sampled in each system. In Springer Creek, a single control was sampled and represented a combination of the basic characteristics at two treated sample sites.

Fisheries Results

At treated sites, the combined density of trout and salmon, ranging from 1.06 fish/m^2 to 5.89 fish/m^2, was 94 percent higher on average than at respective control sites. Trout fry were 86 percent more numerous in treated sites compared to control areas, whereas coho fry were 105 percent more numerous. Trout parr were captured only in Springer Creek, but they were three times more numerous in treated sites compared to the control areas in this creek.

Treatments of riffles appears conducive to trout survival, but may not be so for coho fry. Sampling of treated areas dominated by glide habitat suggested that such areas may be suited to coho while at the same time accommodating above average densities of juvenile trout.

The 1981 boulder placements were, on average, 60 to 70 percent effective one year after placement. In most instances, placements showed little disturbance and infilling, due probably to large rock size and the tight, complex clustering of rocks in the streambed.

This study has established the value, in terms of providing more productive fish habitat, to be gained through boulder placements in small streams. However, only by monitoring the results over an extended period of time will the long-lasting results of this enhancement technique be established.

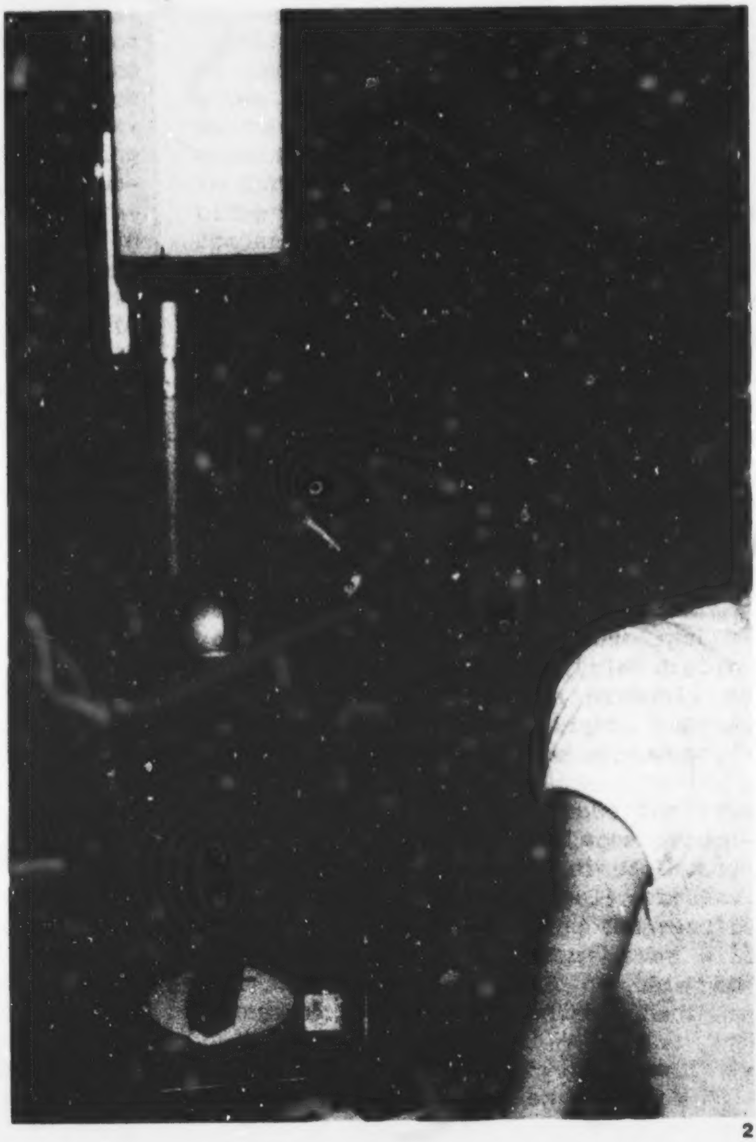
Contact: Bob Griffith, Fisheries
Biologist, Fish Habitat
Improvement Section, Fish and
Wildlife Branch, Victoria.

1

Program Development

1. *Surplus fish that return to hatcheries such as Capilano are sold to the highest bidder.*

2. *Coded-wire nose tags are decoded under a microscope with a video camera attached.*



2

Program Development and Bio-economic Evaluation

Program Development Branch

The purpose of SEP's Program Development Branch is to provide advice on program policy and direction to ensure that maximum social and economic benefits are derived from the extensive application of salmonid enhancement technology. Specifically, the federal/provincial agreement signed on March 1979 commits the governments of Canada and British Columbia to pursue:

- augmentation of national and provincial income
- creation of employment opportunities for Canadians
- improvement of economic opportunities for native Indian people (consistent with the need to preserve their social and cultural heritage)
- promotion of the development of economically disadvantaged communities or regions
- expansion and improvement of resource and environmental opportunities.

Entailed in these responsibilities are strategic and operational planning functions for:

- establishing enhancement production targets
- evaluating the comparative merits of alternative enhancement/management strategies
- developing project options to meet desired targets
- evaluating the merits of selected projects before and after completion.

The Branch is also responsible for assessing program components and the program as a whole to facilitate decision-making for SEP's future. In this respect, evaluation of the Public Involvement and Small Projects components of the Special Projects Branch were initiated in 1982.

In 1982, Branch representatives were heavily involved in continued planning for the next phase of the program. The manageability of the massive list of enhancement opportunities identified last year was established in consultation with Field Services Branch staff. Two hundred manageable enhancement opportunities were identified and these were used to develop three alternative plans for consideration by senior management, the central agencies and Treasury Board. In addition, Branch staff spent considerable effort preparing the various documents to support the proposals for SEP continuation.

Contact: Harold Swan, Associate
Executive Director, Program
Development.

Biology

In 1982, it was recommended that SEP be extended beyond 1983/84, and a list of candidate projects for the next seven years was prepared for Departmental and Cabinet approvals. An essential requirement for candidate projects was that they be considered manageable from a fish-harvesting perspective. Program Development biologists, in consultation with fisheries managers, were given the responsibility of establishing project manageability prior to the formulation of the recommended plan for Phase II.

Program Development biologists continued their advisory function in the international salmon interception negotiations with the United States; a draft treaty was initialled by the senior negotiators for both parties. The insights gained in this activity were useful in the identification of manageable enhancement opportunities, some of which are contained in the recommended Phase II plan.

In 1982, contract studies were undertaken to evaluate two program areas, the Public Involvement Program and the Small Projects Unit. These programs were evaluated in light of the goals and objectives established for each when Phase I was started.

In addition, a field project was completed under contract: fish quality values were determined for sockeye sampled from four locations along the Skeena River. The data collected will be used to compare quality and price differences for fish taken in terminal areas as opposed to mixed stock areas. In-house work involved reviews and updates of salmonid brood summary data for project reporting, planning, and evaluation purposes. Preliminary investigations on determining production benefits associated with enhancement techniques were also started. Further details of these assessment activities, as well as the management-related activities, follow.

Contact: Bill Schouwenburg, Senior
Program Development
Biologist, Program
Development Branch.

Economics

Program Analysis

The benefit/cost approach recognizes that society has a number of goals, some of them quantified in terms of national income and others not. Similarly, benefit/cost analyses of SEP projects conducted by SEP economists also recognize that this Program has impacts beyond those measurable in national income terms. Accordingly, a framework has been developed that attempts to forecast and describe not only national income impacts of SEP proposals, but also, those impacts in other areas such as regional development, the well-being of native communities, employment, and environmental and resource preservation.

In 1982, SEP economists assessed the entire first phase of the SEP program for use in the annex to the Cabinet submission, analyzed more than 500 enhancement projects proposed for Phase II development, and developed a number of program options for Phase II.

a) Phase I

A detailed program evaluation on the entire first phase of SEP was prepared for use in the annex to the Cabinet document and for presentation to the Salmonid Enhancement Task Group (SETG) and the SEP Board (SEB).

SEP production capacity as of March 31, 1982 was 32.1 million pounds (14.1 million kilograms) of adults annually. This figure represents expected adult catch using current expected egg-to-adult survival rates and projected future catch rates. It is estimated that the capacity to produce 42.5 million pounds (19.3 million kilograms) of adults annually will be met by the end of Phase I in March 1984. This total represents approximately 85 percent of the original production target.

A number of key assumptions used in calculating the benefits and costs of Phase I have been modified in response to the concerns of economic analysts. These include the level of capitalization, the rate of price increases, and the level of labor costs. By incorporating these changes into the "most likely" scenario, the benefit/cost ratio for Phase I was 1.4:1.0 using a 10 percent discount rate. The present net value of benefits, expressed in 1982 dollars, equalled $132.5 million.

In terms of the regional development account, benefits accruing to the less-developed regions of B.C. are projected to amount to $99.1 million (1982 dollars), which is 40 percent of the goal originally established for Phase I.

Impacts on native people resulting from work completed in Phase I are expected to be significant. The Community Economic Development Program (CEDP) has proven effective in generating project-specific employment and SEP production will generate income and employment in both the harvesting and processing sectors. In addition to these impacts, it is estimated that this program will increase the food fish catch. The present value of this catch is estimated, if valued the same as the commercial catch, to be $14.3 million (1982 dollars).

b) SEP Continuation

In 1984, SEP will move into a transition phase for two years. During this time, Phase I of SEP will be further evaluated. A number of small-scale production projects which address urgent needs such as chinook conservation and habitat restoration will be carried out during the transition period. Major investment in fish production will be postponed to permit more complete assessment of Phase I, to improve integration of enhancement and stock management activities, and to promote clearer understanding of the implications of issues such as the Canada/U.S. Salmon Treaty and native land claims. A plan for fleet rationalization and cost recovery will also be developed for later adoption.

Policy Analyses

The planning process requires continuous improvements to evaluation methodology. Major work was done in this area in preparation for the planning of Phase II of SEP. The following projects were undertaken in 1982:

- real salmon price projections were reexamined
- new data were collected on variable salmon harvesting costs
- tentative estimates of capital investment in the commercial fleet were made
- unemployment figures were studied to determine the extent to which SEP can be expected to generate net new employment
- an impact study was undertaken to determine the effects of SEP on industry as well as the distribution of those effects.

Two important studies currently underway will assist in the development of comprehensive methods of evaluating the Public Involvement Program and the Special Projects Division of SEP.

a) Recreational Fisheries

Marvin Shaffer & Associates Ltd. completed and submitted to the Department of Fisheries and Oceans a report entitled, "The Economic Impact of Resident Sport Fishing in British Columbia." The purpose of this study was to estimate the direct and indirect employment and income impacts associated with resident tidal and nontidal sport fishing in B.C. in 1980. This study used the results of two previous surveys--"The 1980 National Sport Fishing Survey" and a second by Edwin, Reid & Associates Ltd., on employment and income coefficients--to estimate these impacts. The results were also compared with estimates derived from existing regional input-output models developed by Statistics Canada. Based on these two approaches, the direct income impact of resident tidal and nontidal angling in 1980 was estimated at between $38 to $40 million and direct employment in the range of 3,500 to 4,000 person-years.

b) Cost Recovery

SEP generates substantial benefits for the salmon fishing industry in British Columbia. At the start of the Program, it was envisioned that those who benefit from SEP should bear its costs, and therefore cost recovery was included as part of the mandate of the Program. Now that salmon produced by

Table 47

Sales and Revenue of B.C. Tidal Water Sport Fishing Licences in 1981 and 1982

Type	Number		Dollar Value	
	1981	1982	1981	1982
Resident (R)	228,127	241,585	$1,138,600	$1,207,900
Non-Resident (N)	19,340	17,771	386,800	355,400
Non-Resident, 3-day (T)	12,832	12,606	128,300	126,100
Resident/Non-Resident 1-day (D)	21,948	20,963	76,800	73,400
	282,247	292,925	$1,730,500	$1,762,800

SEP are starting to be caught in coastal fisheries, it is reasonable to levy cost recovery charges on resource users.

i) Commercial Fisheries

Commercial salmon fishermen paid $1,833,000 in vessel licence fees in 1982, and half of this amount, $916,500, was directed toward SEP cost recovery. An examination of the impacts of additional landing royalties on the commercial fleet was conducted; however, royalties cannot be imposed until the appropriate legislation is passed.

ii) Sport Fishery

Almost 293,000 sport fishermen purchased tidal water sport fishing licences in 1982. This represents an increase in sales and revenue over 1981 of approximately four percent.

Net revenues of $1.76 million from the 1982 licence sales will again be credited as the recreational contribution toward expenditures incurred during Phase I of SEP. This brings the total recreational contribution, since the licence was first introduced in 1981, to over $2.7 million.

c) Canada - United States Salmon Negotiations

Canada and the United States have been negotiating management strategies for their respective salmon fisheries for more than a decade. In December 1982, negotiators for the two countries initialled a framework agreement. This agreement sets out the principles that will guide management programs, and contains fishing proposals for 1983. This agreement must be ratified by both the Canadian and American governments, however, before it becomes law. The main factor of the agreement is the right of each country to harvest an amount of salmon equivalent to its own production. This condition, along with new arrangements for the management of Fraser River and trans-boundary salmon stocks, should facilitate the development of enhancement projects which previously were considered undesirable.

d) The Commission on Pacific Fisheries Policy

The Commission on Pacific Fisheries Policy, conducted by Dr. Peter Pearse, published its final report in September 1982. While applauding the Program both in terms of fish production capacity and economic performance, Dr. Pearse identified several key issues that deserve greater attention in the future, including manageability aspects of enhanced stocks and the "enhancement through management" alternative. In keeping with these observations, Pearse recommended continuation of Phase I operations (including ancillary programs such as Public Involvement and Community Economic Development), with greater emphasis on the monitoring and evaluation of completed projects as a basis for Phase II planning.

The recommendations of the Pearse Commission are reflected in a SEP Planning document developed during the last quarter of 1982. Pearse's recommendations will have an important bearing on activities of the Program Development Branch in the future.

Contact: Steven Wright, Economist,
Program and Project Analysis;
Patrick Loftus, Recreational
Fisheries, Program
Development Branch.

Systems Group

a) EPIC - SEP Phase I Database

EPIC continues to be used in the annual Program planning exercise. Each year, revised budget and production projections are collected from all SEP Divisions. This forms the base for economic evaluation of SEP's performance and review of its production goals.

During 1982, EPIC development included two major data collection exercises. Egg-takes, juvenile releases and expected adult production from brood summaries and status reports for brood years 1976 to 1981 were added to the database. As well, SEP expenditures for the 1977 to 1981 fiscal years were stored for each project. These actual financial and production data are used in responding to information requests and in improving the precision of economic and fisheries management analyses.

Future goals for EPIC are to continue with established data collection exercises, to conduct a review of evaluation data requirements which would define the scope for EPIC development, and to produce a series of general reports.

b) ALEVIN - SEP Continuation Database

The EPIC database system was expanded in 1982 to include ALEVIN. Created as a SEP continuation planning tool, ALEVIN contains information on approximately 500 potential enhancement opportunities. Data are stored for each location and specify possible technology types, production targets, cost forecasts and the evaluation results for the five accounts. This new database is used to evaluate the large amount of data available for formulating SEP continuation plans.

c) Production Model

The SEP production model is used to evaluate all projects and programs using the five-account methodology. In 1982, many of the key assumptions in this model were modified. Rates of capitalization in the fishing fleet and the opportunity costs of labor were some of the new variables introduced into this model, while existing variables, such as real wholesale price changes and variable catching and processing costs, were updated.

This model was used to analyse over 500 enhancement opportunities and to develop numerous program options for Phase II.

In future, methodologies are to be refined, and the program will be modified to analyze such issues as the costs of stock interactions and "enhancement through management."

d) The Pacific Region U.S. - Canada Negotiating Systems (PRUNES)

The Pacific Region U.S. - Canada Negotiating System (PRUNES), in operation since 1979, comprises a seven-year catch base (1971-1980) for all commercial fisheries on the Pacific coast, from Alaska to California inclusive.

This system contains files on annual commercial catch for each statistical fishing area, annual landed and wholesale prices, and coastwide average weights for chinook, coho, chum, pink and sockeye salmon. It is able to separate out fishing area catches to indicate for each gear type, and for each species, the estimated composition of stocks intercepted in any fishing area. The "Stock Composition of Fishing Area Catch" table illustrates, by percent and pieces, the estimated portion of any stock(s) caught in a known fishing area. An actual year(s) catch for any species, gear type, and fishing area remains the same, but the catch is separated to show the estimated stock composition of the fishery. Conversely, the "Fishing Area Catch of Specific Stocks" table summarizes all presently identifiable stocks and lists all fisheries that intercept a specific stock.

PRUNES was not fully operational througtout 1982 due to increasing costs for operation and less frequent requests for information. Therefore, several copies of key tables were prepared and are available for reference at no additional operating cost. These reports have been used primarily by Regional Planning staff and consulting companies. An evaluation report of the system was also completed in 1982. This report identified the system's current objectives and capabilities, operational requirements, benefits and drawbacks as well as recommendations for enhancement of the system.

e) Biostandards

Biostandards are a set of life-expectancy tables which predict the chances that salmonids of a particular species and from a specified region of B.C. will survive from one life stage to the next. For example, the tables provide estimates for the percent survival of Fraser River chinook eggs to the fry, smolt and adult life stages. The tables were initially drawn up in 1975/76 as an aid in the planning and cost analysis of projects for Phase I of the Salmonid Enhancement Program. More recently, however, the biostandard tables are widely used by the Department of Fisheries and Oceans to plan and evaluate the fisheries and habitat management strategies. After a time, though, Fisheries biologists required more detailed survival rates than these tables could supply. Specifically, they needed survival rates for fish reared using newly-developed enhancement techniques in specific geographic areas.

In March 1982, biologists from different departments within Fisheries and Oceans and the B.C. Fish and Wildlife Branch formed the Biostandards working group. This working group has been charged with the task of formulating a new set of biostandards tables. The survival rates in the new tables will be compiled from a much larger base of survival rates, taken from streams and rivers throughout B.C. These new rates will be applicable with much greater statistical and geographic precision than those currently used. The tables will also contain related information such as age, length, weight and fecundity data. All sources used in making up these tables will be readily accessible through a bibliography.

Throughout the remainder of 1982, biotechnical staff working for the Program Development Branch of SEP have been compiling the tables from data submitted in many forms, from published reports to field-crew diaries. These data should be loaded into a main-frame computer by July 1983, where this information will be accessible to any employee given some rudimentary training in the use of the computer's terminals. The data will be available in the form of prepared or ad hoc reports for which the user will pay.

f) Microcomputers

SEP makes extensive use of microcomputers in its day-to-day operations. The use of these microcomputers is continuously expanding, and new uses are applied in graphic production, statistical analysis, word processing, data storage, and budget management. When a microcomputer is inadequate, it can be used to communicate with more complex computers, such as those located at universities and private-systems firms.

Computers are also used at hatcheries and spawning channels throughout the province to perform the many calculations required for efficient operation. The uniformity of this computerized information will improve the biological analysis of enhancement techniques.

Microcomputers are used at regional headquarters in a number of capacities. Modelling of the effects of proposed management and enhancement strategies is one common usage. Models have now been developed for many areas of the province including the Skeena River, Atnarko River, Fraser River, Georgia Strait and Johnstone Strait. These models should help in choosing the best strategies for enhancing Pacific salmonids.

Microcomputers are also used to analyze data for international negotiations with the United States and to store data for the Mark Recovery Program.

Contact: Gordon McIntyre, Program
Development Biologist,
Program Development Branch.

SEP Phase II Program Planning

Program Development biologists were heavily involved in the complex process of analyzing and compiling the list of enhancement opportunities into enhancement plans.

The first step towards development of a viable enhancement plan was to condense the massive list of more than 500 enhancement opportunities, produced by the Enhancement Opportunities Committee, into a short list of some 200 manageable opportunities. This was done through a project-by-project analysis of the species and numbers proposed for each of the enhancement opportunities, based on current fishing patterns and current fisheries management practice. Many of the projects were found to be unmanageable; that is, the enhanced production could not be adequately harvested in existing fisheries or in any new, discrete fisheries without severely affecting other unenhanced stocks. Several other projects were found to be manageable only in concert with other projects; these projects were grouped into enhancement packages. If an opportunity was identified as part of a package, it wouldn't be considered manageable unless it proceeded coincidently with all of the other package components. Finally, there remained those projects which would be manageable in current fisheries, or in new discrete fisheries. Some projects were identified as manageable if they were seen as solutions or partial solutions to current fisheries management problems.

This short list of manageable enhancement opportunities was then taken to the area managers and management biologists for review and refinements. The refinement process was followed by a final review and presentation to the Regional director-general, his directors and their advisors. After this approvals process, the final list was used to develop a series of plans for SEP Phase II. One of these plans, the "Recommended Plan", was endorsed by the Salmonid Enhancement Board and the Task Group, and was forwarded to Ottawa. A decision is expected early in 1983.

Contact: Susan Steele, Don Radford,
Program Development
Biologists, Program
Development Branch.

SEP Manageability Studies

South Coast

The Management Biology Unit undertakes various studies and activities funded through the Salmonid Enhancement Program to provide biological input to the planning, design and implementation phases of the program.

In the 1982-1983 fiscal year, the South Coast Division undertook four such studies.

Contact: Don Anderson, Senior
Management Biologist, South
Coast Division, Field
Services Branch.

a) Manageability Planning

This activity was conducted in support of the Geographic Working Group planning functions. Two main tasks were accomplished.

First was the development and presentation of a transplant policy. This policy, in addition to the existing disease considerations of transplants, acknowledges the viability and genetic considerations of transplants.

The second activity focused on the desirability and feasibility of larger-scale chinook enhancement for the west coast of Vancouver Island. This information is being edited for publication. The published report will cover the current production and distribution of marked stocks which are used as indicators of what might be expected of large-scale enhancement of selected chinook stocks on the west coast of Vancouver Island.

Contact: Steve Heizer, Management
Biologist; Tom Shardlow,
Management Biologist, South
Coast Division, FSB.

b) Data Base Completion

The objective of this activity is to complete documentation of the stock status of chum salmon on the west coast of Vancouver Island. The report is a compilation of biological data (catches, escapement, test fisheries and some biophysical information) as well as enhancement and management recommendations for the development of harvest strategies.

Contact: Steve Heizer, Management
Biologist, South Coast
Division, FSB.

c) Kennedy Lake Project

Kennedy Lake is one of the lakes fertilized in 1982 under SEP's lake enrichment program. In order to develop harvest strategies when surplus sockeye return to this system, preliminary estimates of the size and timing of returning stocks were attempted. (This program was funded jointly by SEP, FSB, and job creation.)

Some 2,500 sockeye were tagged, and 155 were recovered. The age composition of the returning fish was also constructed. This technique is expensive and labor-intensive. The general consensus resulting from the preliminary attempt is that a counting fence on the lower Kennedy River would permit the best estimation of the size and timing of returning stocks. (This fence could also be used for the collection of brood stock for anticipated chinook enhancement.) A fence, with its ability to accurately estimate run strength, may be the most cost-effective way of optimizing the harvest of Kennedy Lake sockeye.

Contact: Steve Heizer, Management
Biologist, South Coast
Division, FSB.

d) Chum Salmon Stock Identification

The Johnstone Strait - east coast of Vancouver Island chum identification program (jointly funded by SEP, FSB, and PBS) was continued in 1982. The 1982 sampling program covered eight South Coast statistical areas, plus the Fraser River mainstem and major chum spawning tributaries.

Samples of muscle tissue, eye, heart, liver and meristic data were taken from 3,500 chum salmon from a total of 23 river systems and three test fish programs.

Results to date have indicated that electrophoretic analysis of tissues can be used to identify specific chum stocks in a mixed stock fishery such as Johnstone Strait.

Contact: Al Gould, Management Biologist, South Coast Division, FSB; Dr. Terry Beacham, Research Scientist, Pacific Biological Station, Fisheries Research Branch.

Fraser River

a) Fraser River Chinook Tag Recoveries

Between 1976 and 1981, wild chinook tagging programs were carried out in the Fraser River watershed to document timing of ocean migration, fishery contribution and the survival of specific chinook stocks. Tagging was conducted on the Deadman, Nicola, South Thompson, Shuswap, Chilcotin, Chilko and Upper Fraser River (Tête Jaune Cache) chinook populations.

In the coded-wire tagging method, a small (1 mm) binary-coded stainless steel tag is implanted in the nose cartilage of juvenile fish. Tagged fish are identified by the removal of the adipose fin and are subsequently recovered in commercial and sport fishery sampling programs as well as on the spawning grounds. Data generated from these studies will be used to assist in formulating management and enhancement plans for Fraser River chinook.

The 1982 program concentrated on recovering previously-tagged chinook returning to the Chilko, Shuswap and upper Fraser River (Tête Jaune) spawning grounds. During 1982, no tagged chinook were expected to return to other Fraser River tributaries.

A total of 3,388 chinook in an estimated escapement of 10,000 were examined for the presence of tags, and 857 of these were sampled for age, length, sex and spawning success. Forty of the chinook examined lacked adipose fins (indicating the presence of tags) and 30 tags were subsequently recovered. Of these, 12 tags were from the Chilko River and 18 from the Shuswap River. No tags were recovered from the Tête Jaune spawning area on the upper Fraser River. Tagged three- and four-year-old chinook were expected in 1982; the majority of fish will return at age five.

Scale analysis indicated that the majority of chinook sampled from the Chilko and upper Fraser spawning areas were five years old and had spent their first year in fresh water prior to migrating to sea. However, in the Shuswap River spawning area, the majority of chinook migrated to sea in their first year of life and returned to spawn at age four.

Contact: Brian Pearce, Management Biologist, Fraser River, Northern B.C. and Yukon Division, Field Services Branch, New Westminster.

b) Upper Pitt River Coho Enumeration and Tag Recovery

A two-year coded-wire tagging program was conducted in the upper Pitt River during 1979 and 1980 in order to provide information on the fishery contribution, timing, survival and marine distribution of this river's coho stock. A total of 168,000 juvenile coho were tagged during 1979 and 1980.

The objectives of the 1982 program were to determine:

- number of marks in the escapement and the relative contribution of each tag group to the total
- location and relative distribution of spawning, and the time of spawning in each area
- age, length and sex composition of the stock
- total upper Pitt River coho escapement during 1982.

The 1982 escapement was estimated by a tag recovery program. A total of 700 coho were disc-tagged, generating an escapement estimate of approximately 7,250 fish, of which about 960 were coded-wire tagged. Further analysis is pending.

Contact: Neil Schubert, Management Biologist, Fraser River, Northern B.C. and Yukon Division, Field Services Branch, New Westminster.

c) Coded-Wire Tagging Of Wild Coho Smolts in Salwein Creek

This program was undertaken to determine whether or not there were significant differences in the survival, catch contribution, and migratory behavior of wild and hatchery coho from the same stream. Wild coho smolts from Salwein Creek, a small tributary of the Vedder-Chilliwack River, were captured and tagged. Adults caught in the fisheries and those returning to the stream in 1983 will be analyzed and compared to Salwein Creek coho that have been reared at Chilliwack hatchery and subsequently released as smolts in Salwein Creek.

Contact: Neil Schubert, Management Biologist, Fraser River, Northern B.C. and Yukon Region, Field Services Branch, New Westminster.

d) Coded-Wire Tagging of Wild Coho Smolts in Little Campbell River

This program was undertaken with the primary objective of assessing smolt-to-adult survival, exploitation rate and catch contribution of coho from the Little Campbell River, a small stream draining into Semiahmoo Bay near White Rock. Approximately 16,000 coho smolts were trapped by using a juvenile counting fence. These smolts were implanted with coded-wire tags and then released. Subsequent adult returns to the stream and to the various ocean fisheries will be monitored and analyzed.

In addition to tagging coho, information on the migration timing, age and length of coho, chinook, steelhead and cutthroat was obtained.

This program was completed with assistance from members of the Semiahmoo Fish and Game Club.

Contact: Neil Schubert, Management Biologist, Fraser River, Northern B.C. and Yukon Region, Field Services Branch, New Westminster.

North Coast

a) Cumshewa Inlet Test Fishing

In 1978, Japanese-style chum enhancement was initiated on Pallant Creek near Moresby Camp, Cumshewa Inlet, to provide more fish to the traditional fall chum fishery on the Queen Charlotte Islands. Prior to the first returns of enhanced four-year-old chums in 1982, test fishing was conducted to investigate the feasibility of using catch per unit of effort (CPUE) data and mark-recapture sampling techniques as a means of assessing stock abundance in the Inlet. Two gillnet vessels were chartered to fish at standardized times, tides and sites. In addition, tags were applied to chum salmon between test fishing sets at the index sites. One seine vessel was chartered to conduct mark-recapture sampling at the head of the Inlet where spawners were discovered to hold for two to four weeks before migrating upstream. This study provided an estimate of the holding population at three to four-day intervals. Analysis of these data will provide recommendations on future test fishing and the effective management of hatchery returns.

Contact: Lynda Orman, Queen Charlotte Island Biologist, Field Services Branch.

b) Kitsumkalum-Morice Deadpitch

The 1982 deadpitch program on the Kitsumkalum and Morice Rivers was conducted from September 1 to October 9.

In the Morice system, 201 chinook were examined for marks; in the Kitsumkalum, 723 chinook were examined. Of these fish, three marked fish were recovered, all were from the Kitsumkalum River. These fish all had their adipose fin removed.

Sampling was also conducted for length, sex and age in each system. In the Morice, 51 chinook were sampled, while 259 chinook were sampled in the Kitsumkalum.

Contact: Lester Jantz, Biologist,
Biology Unit, North Coast
Division.

Program Evaluations

In conjunction with the Special Projects Division, assessment biologists prepared contracts to evaluate the Public Involvement Program (PIP) and the Small Projects Unit (SPU). Contracts were established in September 1982 to complete these evaluations by March 1983. The third component of the Special Projects Division, the Community Economic Development Program, was evaluated in 1981-1982.

As the SEP program approaches completion of Phase I enhancement activities (1977-1984), work is now underway to develop the plan for Phase II. Therefore, it is critical that thorough evaluations are completed on existing Phase I programs. The PIP and SPU had not been fully evaluated since their inception. The terms of reference for the Public Involvement Program assessment were to:

- evaluate the goals and objectives of the participation, advisory, education and information components and determine whether they are being met
- assess the value of the Public Involvement Program performing an advisory, educational and informational function for SEP and DFO
- undertake a benefit:cost analysis of PIP's participation projects
- review PIP's program management and planning process.

For the Small Projects Unit assessment, the terms of reference were to:

- evaluate the small projects in light of their technical objectives
- undertake a benefit:cost analysis of production projects
- develop a methodology to measure the economic benefits of non-Fisheries organizations participating in constructing, operating and maintaining a small facility
- identify the social impacts resulting from the SPU
- determine the environmental impacts resulting from the SPU and assess their performance in terms of their resource and environmental preservation objectives
- review SPU's program management and planning process.

Contact: Margaret Birch, Assessment
Biologist, Program
Development Branch.

Maintenance of Major Facilities

An initiative to update engineering information on all existing facilities in operation was implemented at the end of the fiscal year 1981/82. Inspections at 17 hatcheries were carried out by groups consisting of the hatchery manager, the project engineer involved in the construction of the facility and the senior engineering maintenance technician. The reports contain very useful information on the condition and adequacy of these facilities, as well as information on repairs and modifications required to satisfy the present operational needs and capacities.

From these reports, maintenance work lists were drawn up and priorities assigned. The maintenance budget in 1981/82 allowed work to be done on most of the high priority projects.

Some projects carried out were:

Mathers Creek -	covered the aeration tower to minimize algal growth

Pallant Creek - replaced damaged pad at adult collection fence with a larger concrete pad

Pinkut Creek - cleaned out approximately 1,000 m^3 of gravel collected over the years at the water intake

Snootli Creek (Bella Coola hatchery) - provided additional rearing capacity with ten aluminum rearing troughs and four 3-m diameter fibreglass tanks; improved wells and groundwater supply

Birkenhead River - constructed a new 7-m aeration tower for six packed columns to improve the quality of groundwater

Big Qualicum River - provided an 11 m X 11 m extension to the incubation room
- modified intake and 300-mm diameter pipeline to improve incubation water supply

Conuma River (Tlupana Inlet Project) - improved services and provided concrete block enclosures for four well-houses
- upgraded various electrical installations throughout the site

Little Qualicum River - repaired the diversion fence and flood-channel rip-rap

Puntledge River - repaired abutment for diversion fence and provided a boat ramp
- replaced freezer enclosure with new 4 m X 3.5 m insulated aluminum enclosure

Quinsam River - provided 6-m jib crane and new screens for the Cold Creek water intake

Robertson Creek - improved fishway to provide better fish access and retention
- provided 3,640 l/min standby incubation water supply.

Contact: John Beyer, Senior
Engineering Technician,
Engineering Division.

Mark Recovery Program

The Salmon Services Unit and Special Projects Unit received funding from both the Field Services Branch (FSB) and the Salmonid Enhancement Program to carry out the province-wide Mark Recovery Program (MRP) in 1982. This program samples B.C. commercial and sport fisheries to recover fish bearing coded-wire tags and fin marks. The Salmon Services Unit also carries out commercial and sport log-book programs, coordinates the purchase and supply of coded-wire tags for marking, coordinates the reporting of coded-wire tag and fin-clip release information to the Pacific Marine Fisheries Commission, and coordinates and processes recovery information on Floy and Petersen disc tagging projects.

The program began in 1973, sampling chinook, coho, and steelhead trout for missing adipose fins (the small fleshy fin anterior to the dorsal fin). These salmonids carry a microscopic (1 mm) piece of stainless steel wire in their nose cartilage. The coded-wire tag is injected in the nose of juvenile fish and is etched with a specific code denoting the origin of the fish. The value of tag recovery data on the timing, migration, and exploitation of both Canadian and American stocks is crucial to fisheries management and U.S./Canada salmon interception negotiations. The data are also vital for the evaluation of SEP facilities and research, and for future enhancement planning.

In 1982, commercial catches of chinook, coho, steelhead trout, chum, and pink salmon were sampled at processing plants in Prince Rupert, Namu, Port Hardy, Tofino, Ucluelet, Vancouver, and Steveston. Six crews sampled 1,281,518 fish, collected heads from 20,781 adipose-only marks, recorded 1,676 fin marks, and collected 61,090 biological samples. These figures show a 70 percent increase in numbers sampled and a 6 percent increase in adipose marks over 1981. These increases reflect the first year that a directed effort has been made in sampling chum salmon coast-wide for coded-wire tags. Sample numbers for coho increased dramatically over 1981, reflecting the increased coho catch.

Voluntary returns of sport recoveries continued in 1982, but the number of recoveries was down 20 percent from the previous year. This decrease may be attributed to a reduction in marking of stocks resident in Georgia Strait and also to a decline in angler participation. During 1982, the program processed 8,371 heads turned in at 160 head depots located at boat docks, tackle shops, and DFO offices throughout B.C.

Anglers who turn in the heads of adipose-only clipped fish receive information on the origin of their fish, a Head Recovery Program button, and a copy of the Salmonid newsletter. They are eligible for eight annual prize draws of one $500 prize and six $50 prizes each draw.

In addition to the dissection and tag reading of commercial and sport recoveries, the mark recovery dissection laboratory in North Vancouver provided support to other DFO projects by processing heads from escapement steelhead, chinook, and coho. Support to research groups was given by processing smolts from an enumeration project in the Quinsam River estuary. Other analyses included heads from a shaker study, heads from a troll observer program, and an incidental recovery from a hake fishery trawler.

Data collected by the Mark Recovery Program were edited and entered into computer terminals. An on-line entry system enabled the program to process the data as they were received, and during the year, in-season reports were distributed to provide users with up-to-date information. The format of the 1980 and 1981 annual reports was improved and readied for publication.

In 1983, the Mark Recovery Program expects to produce special user group reports such as an annual review of sport recoveries, a commercial troll newsletter, and summaries of Petersen disc tagging. The 1980, 1981, and 1982 annual reports will be published and distributed. A new computer system is being looked at which will provide better computer entry and retrieval formats.

The MRP also coordinated information from Petersen disc and Floy tagging programs. Files are kept on each project, recording where and when the tagging was done, why the tagging was done, which species were tagged, and the numbers tagged. Fishermen who return the tags are notified of prize draws and rewards (where applicable) and informed of the project during which their tags were applied.

The year 1982 marked the inception of the International Salmon Tagging Program (ISTP) conducted under the interim U.S./Canada Salmon Interception Agreement. In excess of 200,000 tags were applied to sockeye and pink salmon. The North Coast Division (DFO) applied an additional 3,800 tags to sockeye and chinook in conjunction with the ISTP. Other tagging projects were conducted on the Babine, Nimpkish and Kennedy Rivers, in Cumshewa Inlet, and on various rivers feeding the Fraser River.

The MRP office stores an inventory of discs, pins, washers and baffles that are available on request.

During 1982, the Mark Recovery Program spent $652,000. Of this, SEP contributed $450,000. Three person-years are allocated to MRP, of which one is funded by SEP.

Contact: Don Bailey, Chief, Salmon
Services; Vic Palermo,
Biometrician/Programmer.

FISH Microcomputer System

The development of a computerized data management system for hatcheries has been underway since 1980. The system operates on Apple II microcomputers and utilizes a package of programs known as FISH (Fishculture Information System for Hatcheries). These programs were developed by Enhancement Operations biologists and are now largely complete.

The FISH program package consists of data management programs for juvenile and adult fish, and utility programs for statistics, modelling fish growth, calculating gas solubility and other hatchery applications. There is also a comprehensive disease treatment program whereby the user can select any of 24 different fish diseases for which the program will supply suitable treatments, notes on treatment chemicals and calculations necessary for the administration of correct dosages.

There are now ten hatcheries in B.C. equipped with microcomputers, with plans to purchase and place three more Apple II microcomputers in 1983. Training sessions and custom programming are ongoing at each facility. Extensive documentation for both system users and programmers has been prepared and will be published in 1983.

Contact: Anne Kling, A/Bio Program
System Administrator; Carol
Cross, A/Assessment
Biologist, Enhancement
Operations.

Surplus Egg and Fish Sales

Adult fish and eggs surplus to production requirements are available from major hatcheries for sale or for research purposes to other groups or individuals. In 1982, some 5.35 million surplus eggs were supplied to commercial aquaculturists, public involvement groups, and researchers. Of this egg total, 3.36 million were coho, 1.1 million chinook and the remainder pink, chum and steelhead. Further, 56.4 percent of the total surplus eggs were supplied to commercial aquaculturists at a cost of $10 per thousand for green eggs and $14 per thousand for eyed eggs. Researchers and CEDP projects receive their eggs free of charge. Egg prices have not increased since 1978.

All egg requests must first be approved by the Transplant Committee before eggs can be supplied. Following approval, every attempt is made to satisfy the request in terms of egg number, development stage, and stock. Depending on facility escapements however, it is often not possible to comply exactly with requests, and contingency arrangements are made where possible.

With regard to surplus adults, approximately 610,000 kg of fish were sold in 1982 and 29,823 fish supplied to the native food fishery.

Total revenue generated by surplus egg and fish sales in 1982 was $584,018.60.

Contact: Carol Cross, A/Assessment
Biologist, Enhancement
Operations.

Table 48

1982 Fish Sales from Six Hatcheries

Species	**Total Weight (in Kg)**
Bright coho adults	38,509
Dark coho adults	159,148
Bright coho jacks	13,851
Dark coho jacks	12,576
Dark pink salmon	2,001
Dark chum salmon	27,466
Dark chinook adults	207,960
Dark chinook jacks	44,492
Bright chinook jacks	1,000
Carcasses (all types)	102,311

Fish Quality Study

Aquatic Resources Ltd. was contracted to sample sockeye at four locations on the Skeena River from mid-July until late September 1982. Fresh and frozen samples from the fish were canned and smoked so that the commercial value of fish and their products could be assessed.

The purpose of this work stems from the efforts by Program Development staff to develop commercial terminal fisheries values for use in SEP's planning and evaluation models, and to estimate production benefits to the commercial, sport, and native food fisheries. Presently, these models use values for fish caught in mixed stock fisheries destined for the fresh, frozen and Grade A canned markets. However, in recent years, terminal fisheries have been held near river mouths to Robertson and Qualicum River hatcheries, and it is foreseeable that the number of terminal fisheries will gradually increase as Phase I and proposed Phase II production contributes to the catch over the proceeding years. Therefore, it is important to investigate: if there are any commercial value differences for catches made in mixed stock versus terminal areas; and whether increased distances from the river mouth would have an effect on fish quality and, ultimately, the value difference of the fresh, frozen, smoked, and canned products.

The results of the work, completed in December 1982, are summarized in a series of tables which describe the fish collected and the details of the product evaluation. The handling, processing and product evaluation were completed in accordance with DFO Fish Inspection guidelines. Photographs were also taken of the sockeye samples to associate the results of the evaluations with the original appearance of the fish. A preliminary analysis of differences in fish quality values at various terminal locations is currently underway. This analysis will be completed by June 1983.

Contact: Margaret Birch, Assessment
Biologist, Program
Development Branch.

Feed Quality Control Program

Enhancement Operations and the West Vancouver Laboratory cooperated to implement an intensive feed quality control program in 1982. The program was designed to allow sampling of ingredients and finished feed at the production site, with subsequent chemical analysis in Vancouver and rapid feedback of results. Analysis was carried out under contract by Can-Test Ltd.

Samples were taken from the manufacturers of all feed destined for B.C. hatcheries. In addition, herring meal and oil samples were taken approximately every two weeks. All samples were forwarded to Can-Test. Duplicates of each sample were stored at the West Vancouver Laboratory in order to provide a reference sample set, which is available for cross-checking and further analysis if necessary.

Chemical analysis results of critical factors were supplied within 4-7 days of sample delivery. If the results were within acceptable limits, the food batch in question was then cleared for use. Detailed analysis results were available within 10-14 days. All results (including some basic statistical analysis) were stored in an Apple computer program.

The benefits of the program are twofold. First, it has allowed biologists to monitor feed quality and highlight problems when necessary. Second, the collection and examination of analysis results has permitted the refinement, and in some cases, the establishment of appropriate specifications for high quality food.

This program will be continued in 1983.

Contact: Carol Cross, A/Assessment Biologist, Enhancement Operations; Jack Markert, Research Scientist, Resource Services Branch.

Homing/Imprinting of Salmonids

Much of SEP's fish production requires importing stocks to a central site for incubation and rearing and then releasing these stocks back into their native streams. In this way, central hatcheries may be able to enhance stream-specific adult returns while retaining economy of scale. It is fundamental to the central hatchery concept that adults return to their native streams and not to the hatchery; however, little information is available on this subject.

This lack of data has prompted a review of published and unpublished data obtained from all Pacific Northwest fisheries agencies. The project was undertaken for SEP by D.B. Lister and Associates Ltd. It was hoped this review would indicate how to locate and operate central hatcheries successfully. Most of the available data were inapplicable or inconsistent; however, the report did produce some useful conclusions:

- within-system smolt releases at locations other than the rearing site (off-station releases) result in more straying than smolt releases made directly from the rearing site
- the rate of straying for off-station releases decreases with increasing distance between the release site and hatchery
- releases to other watersheds are less likely to stray than within-system releases
- straying to the hatchery is a significant portion of total straying
- smolts released off-station can survive at rates comparable to hatchery-released smolts
- guidelines to maximize imprinting for off-station releases are not known.

It became obvious from this report that homing/imprinting studies would have to be carried out for each salmonid species and at many hatchery locations in B.C. to answer critical questions:

- must salmon be held in the release stream for some period of time prior to release in order to imprint them to that stream?
- if holding is necessary, for how long must the fish be held?
- will chinook and coho fry or fingerlings imprint and home more successfully than fish released as smolts?
- what impact will outplanting have on ocean survival?

Comprehensive studies to provide quick answers to these questions were proposed, but their cost was prohibitive. Instead, SEP now depends on data obtained from production marks and releases which will provide at least some answers over several production cycles.

The first recovery of marked chum from central hatcheries located on the Bella Coola River (Central Coast) and Tlupana Inlet (Vancouver Island) occurred in 1982. These systems differ in that the Bella Coola chum stocks spawn in tributaries to the mainstem, whereas the Tlupana Inlet stocks spawn in streams which drain directly into salt water. Chum fry were taken from the central hatchery and released without holding into their native streams in both 1979 and 1980. Preliminary return data have indicated:

- a high rate of straying (24 to 59 percent) between tributaries in the Bella Coola River system
- a reduced rate of straying (between one and 14 percent) between streams that drain into Tlupana Inlet
- at both locations, chum stocks reared and released into the hatchery stream strayed at rates comparable or greater than stocks released off-site.

These results suggest that straying within a watershed is greater than between streams separated by salt water, and that holding prior to release will have little effect on the imprinting and subsequent homing or straying of chum salmon. Survival rates were similar for groups released at the hatchery site or into off-site streams.

For chinook and coho salmon, experiments are in progress at Penny, Quesnel, Chilliwack, Inch, Chehalis and Tenderfoot hatcheries that will provide guidelines necessary to meet the objectives of central hatchery production.

Contact: Ted Perry, Bio Program
Coordinator, Enhancement
Operations.

Mixed Stock Management Slide Package

A slide/tape presentation entitled "Mixed Stock Management" was produced by Program Development biologists. The package describes the problems of mixed stock management and its relation to enhancement, habitat disruption and the international interception problem. Management problems for sequential and mixed stock fisheries are discussed, as well as the additional problems when either enhanced or depressed stocks are present. The show also describes the resource and its problems, and discusses the difficulties involved in formulating appropriate management policies and alternative management options currently available.

Contact: Susan Steele, Don Radford,
Program Development
Biologists, Program
Development Branch.

Coded-wire Tag Analysis

In 1982, major emphasis was placed on compiling and analysing commercial salmon recovery information for salmonid broods that were coded-wire tagged during 1972-1979 at SEP's enhancement facilities. Commercial recoveries have been made on these tag groups throughout 1974-1981. The Field Services and Fisheries Research Branches and SEP biologists have been involved in processing and validating this recovery data so that returns of tagged fish to commercial and sport fisheries (coho, chinook and steelhead, in particular) may be examined in greater detail.

The Program Development Branch uses CWT recovery data to assist in the preparation of overall evaluations of salmonid production from enhancement facilities to the commercial, sport and native food fisheries. Coded-wire tag data also contributes to improving DFO's knowledge on estimates of interception of enhanced and natural stocks. Work in the area of CWT analysis is planned to continue throughout 1983 and subsequent years.

Contact: Margaret Birch, Assessment
Biologist, Program
Development Branch.

Employment Initiatives

In 1982, the Department obtained funds to use for job creation. Program Development biologists, as part of their planning function, helped develop proposals for the use of these funds. The two programs with which this group was most closely involved were the Fisheries Employment Bridging Assistance Program and the NEED (New Employment and Expansion Development) Program.

The proposals developed for job creation foresaw employment throughout the Region in many types of enhancement work. As part of the planning process, activities were geared to the priority needs in each geographic region. The dynamic nature of the job creation programs required development of large computer matrices which allowed rapid modification of job creation plans with changing needs. This method of developing proposals proved to be very useful and will be used again in the future.

Contact: Susan Steele, Gordon McIntyre, Program Development Biologists, Program Development Branch.

Summer Student Activities

Program Development biologists employed four summer students to assist in completing a variety of projects. One summer student completed a report on an overview of the available experimental information on net-pen rearing as an enhancement technique. The topics in this report included discussion on the appropriate location and design of net pens, technical considerations for net-pen rearing and descriptions of successful operations in B.C. An evaluation methodology to determine net-pen opportunities was also prepared. This report is now available in published form.

The other three summer students participated in a project to evaluate the computerization of all age data currently filed at DFO's scale lab. The students composed and administered interviews directed towards potential scale lab users. With the information from these interviews and a review of the information present in the scale lab, a computer sheet format and codes were determined. Chum scale lab data was coded and transcribed, providing an index to scale information available for this species, and a statistical analysis test run was completed. The data quality will be reviewed before computerization of additional species of scale data are undertaken.

Contact: Margaret Birch, Assessment Biologist; Gordon McIntyre, Program Development Biologist, Program Development Branch.

Job Creation Project

FISH Data Entry

Sixteen people were hired to provide administrative, biotechnical, engineering and clerical support for SEP in Vancouver. Most of them were needed to help handle job creation projects. Manpower was distributed to SEP Finance, Special Projects Division, Public Involvement and Job Creation Units, and Facilities Operations, Engineering, and Biological Assessment Programs.

Contact: Bill Caspell, Project Developer, Job Creation Unit, Special Projects Division.

1

Program Direction

1. *The refurbished SEP display travelled widely throughout the province in 1982.*

2. *In 1982, SEP produced a slide tape and videotape program, called "Fishways and Heath Trays," that explains the technology SEP uses to produce fish.*

Heath Trays

2

Program Direction and Communications

Salmonid Enhancement Board

In August 1978, the federal Minister of Fisheries and Oceans, in consultation with the provincial government, established the Salmonid Enhancement Board to provide him directly with advice and recommendations concerning the management and direction of the Program.

The Board is the senior advisory group for the Program and its membership consists of a total of 12 representatives from the federal and provincial governments and from the private sector. Private-sector appointees represent the interests of commercial and recreational fishing, native people, the forestry industry and the public-at-large.

In 1982, Dr. Art May, deputy minister of DFO, took on the role of the Board chairman following the retirement of Donald Tansley. Other new appointees to the Board were Gary Vernon, assistant deputy minister of Pacific and Freshwater Fisheries (replacing Doug Johnston), and Earle Anthony, assistant deputy minister, in the provincial Ministry of Environment (taking over from Al Murray).

Three meetings of the Board were held during 1982, including a joint meeting with the Salmonid Enhancement Task Group. The Board continued to review and comment on SEP's activities and budgetary issues as well as on SEP-related recommendations from the Commission on Pacific Fisheries Policy. Most of its time, however, was devoted to the review of plans and alternatives for the continuation of the Program.

Contact: Pam MacKenzie, A/Secretary to the Salmonid Enhancement Board.

Salmonid Enhancement Task Group

The Salmonid Enhancement Task Group (SETG), the primary public advisory group to SEP, provides the views and advice of a broadly-based, nongovernmental group on matters which are within the responsibility of SEP. The SETG represents the general public and resource user groups through its membership. It reports to the Salmonid Enhancement Board.

Members on the SETG include representatives of commercial and sport fisheries, the processing industry, mining, forestry, B.C. Hydro, municipal governments, education, Consumers' Association of Canada, Native Brotherhood, media, and taxpayers. (See Appendix D for list of current members.)

In 1982, the Task Group held four full-group meetings, three in Vancouver and one in Kamloops. As well, several committee meetings were conducted.

At the annual joint SETG/Board meeting in January, the Task Group discussed the importance of SEP with then Fisheries Minister Romeo LeBlanc. The Task Group emphasized again its support for SEP and expressed its desire for the implementation of a balanced program of enhancement, habitat protection and management for Phase II.

In April, the SETG gave input to SEP staff on the enhancement opportunities identified as possible Phase II projects. It reviewed a discussion paper on species balance which was prepared by SEP staff and updated the SETG statement on coordinated resource management.

The June meeting saw the Task Group examine several areas of SEP:

- the provincial steelhead/cutthroat program
- Regional planning within Department of Fisheries and Oceans
- planning in the provincial Ministry of Environment
- Phase II plans
- salmonid management strategies.

The October meeting in Kamloops dealt with:

- Pearse Report recommendations related to coordinated resource management, the advisory process, SEP, and the SETG policy statement
- options for Phase II; the SETG endorsed the plan favored by SEP management
- SEP budget for 1983/84 fiscal year; the SETG expressed its concern over proposed budget cuts in the public involvement area of SEP.

The Task Group toured a Kamloops elementary school active in studying salmonids and visited the Adams River sockeye run and an enhancement project operated by volunteers.

The 1982 chairman, Tom Murray, had several meetings with SEP staff during the year and attended meetings of the Salmonid Enhancement Board.

Contact: George McKnight, Chairman,
Salmonid Enhancement Task
Group.

SEP Information Program

The SEP information program has two main objectives: to increase public awareness of SEP and to promote the need to conserve salmonid resources and their habitats. The information program reaches the general public, including children and specific/user interest groups, through a variety of media.

Salmonid

During 1982, seven issues of the newsletter were produced. It reports on projects, activities, and issues related to the salmonid resource and has a circulation of 30,000. "Salmonid" is available on a subscription basis at no cost.

Brochures

A brochure, "Stream Care," aimed at schoolchildren, was well received by the schools. The brochure was entered in the International Association of Business Communicators of B.C. evaluation and awards program, and won the 1982 Award of Excellence in the special print category.

Fact Sheets

In 1982, three fact sheets were produced: "Benefits of SEP," "Spawning Channels," and "Marking Salmon."

Slide Tapes

An enhancement techniques slide tape "Fishways and Heath Trays," was produced in 1982. A second audiovisual focusing on SEP's public involvement component will be completed in early 1983.

Displays

The large SEP display continued to be used throughout the province, including:

- joint meeting of the Salmonid Enhancement Task Group and the Board, Vancouver, January 21-22
- University of B.C. open house, March 11-13
- Spruce City Wildlife Association, Prince George, April 23-25

- False Creek Children's Fishery, May 29-31
- Kamloops exhibition, August 27-29
- Coho Festival, West Vancouver, September 3-5
- Centanoka Mall, Salmon Arm, October 4-16
- Robson Square Discovery Fair, Vancouver, October 20-28
- Department of Fisheries and Oceans, Field Services Branch annual meeting, Victoria, November 1-4.

The SEP display underwent some design and content modification; it features new photographs, additional panels, and a section for dispensing brochures and fact sheets. Five tabletop displays were produced for community advisors to use in their meetings and presentations with schools, clubs, and other general public groups. A display promoting the Head Recovery Program was also produced.

Slide File

A library of SEP-related slides is maintained. It is a valuable source from which to select slides for preparing audiovisuals, and for various publications. It is used by interested Department of Fisheries and Oceans staff, the forest industry, B.C. Hydro, and the B.C. Wildlife Federation, among others.

Special Events

The annual False Creek children's fishery was promoted extensively in 1982. Several themes were developed to make the three-day event fun and educational for anglers and onlookers: salmon and commercial fishing; salmon as a sport fish; salmon and culture; and salmon as food. Several volunteers engaged in salmonid enhancement projects received specially-designed community service awards in recognition of their efforts.

SEP Annual Reports

SEP projects are outlined in two annual reports: this large annual report which records the progress of each project, and a summary annual report which provides an overview of SEP. Both reports are available to the general public: the large annual report in limited numbers on request, and the summary report which is mailed to all "Salmonid" subscribers. French versions are available on request.

Contact: James Boland, Head, Public
Involvement Unit.

Educator's Package

The SEP educational coordinator carries out four major responsibilities: writing and editing material for the curriculum package Salmonids in the Classroom; conducting in-service sessions for users of the package; providing input in the development of SEP information materials; and liaising with schools and staff of DFO.

During 1982, the educational coordinator was primarily responsible for the editing and production of revised elementary and secondary components of Salmonids in the Classroom. The new packages are more streamlined; they were reduced from three volumes and four volumes respectively, to one volume for each. The single volumes include lesson plans, student activity sheets, overhead transparencies, reference material, an audio-visual catalogue and student evaluation suggestions.

In addition, 1982 saw the beginning of field-testing of the primary (kindergarten to grade three) component of Salmonids in the Classroom by eighteen teachers throughout B.C. The educational coordinator kept in close contact with these teachers, through correspondence and information-exchange workshops. She also attended key educational conferences in Oregon and

B.C., to exchange information and promote Salmonids in the Classroom.

Work started on developing a version of the package to be used solely by DFO Field Services staff. This package will aid staff in making speeches and presentations to a variety of groups.

Along with her normal liaison and support to package users, the educational coordinator began working with the Vancouver Sun education editor in preparing a series of articles for the newspaper's student education page.

Contact: Linda Bermbach, Educational Coordinator; James Boland, Head, Public Involvement Unit.

Appendices

A. SEP Fish Production, Forecast Catch and Production Capacity

Summary of 1982 SEP Fish Production*

Species	Juveniles Released	Expected Adult Production
Sockeye	285,990,583	3,863,374
Chum	124,533,794	1,890,336
Pink	10,029,162	250,727
Coho	11,063,688	700,593
Chinook	17,572,749	514,657
Steelhead	1,305,902	30,577
Cutthroat	173,519	13,838
TOTAL	450,669,397	7,264,102

*Includes production from all SEP facilities and projects, and lake enrichment.

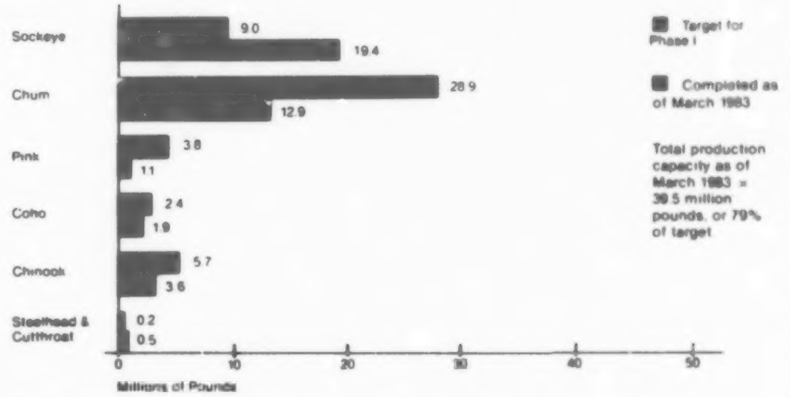
Forecast Catch from Existing SEP Projects* at Full Capacity**

	Canadian Catch	
Species	Pieces	Pounds
Sockeye	4,171,943	23,789,653
Chum	1,211,718	14,098,990
Pink	346,465	1,543,174
Coho	573,939	2,854,931
Chinook	582,841	5,083,392
Steelhead	36,122	371,639
Cutthroat	18,919	193,257
TOTAL	6,941,947	47,935,036

*Projects constructed before SEP as well as SEP projects which are completed as of March 31, 1983.

**Projected Canadian commercial, sport and native food fish catches, each year.

SEP Production Capacity by Species: Phase I Targets and Performance to Date*



* Production capacity measures the capacity of facilities which have been constructed since 1977 (SEP facilities only) and are now operational. The capacity is stated in terms of expected future adult catches, using current facility capacities, current expected egg to adult survival rates of enhancement techniques, and projected future Canadian catch rates.

B. *Financial Statements*

SEP Expenditures by Program Area (in Thousands of Dollars)

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83
Program Area						
Major Production Projects	$1,621	$ 6,754	$11,974	$12,847	$12,897	$ 9,715
Minor Production Projects	252	726	1,098	1,461	1,212	1,211
Pilot Production Projects	283	284	135	244	181	383
Facility Operations and Maintenance	1,344	2,803	3,820	5,777	8,150	9,345
Community Development Projects	453	1,929	2,813	3,168	2,959	3,672
Lake Enrichment	307	676	1,095	1,345	1,454	1,801
Public Involvement	505	829	830	874	1,051	1,278
Reconnaissance/Feasibility Studies	1,581	754	1,508	1,588	990	394
Manageability and Environmental Studies	764	1,725	1,267	1,488	730	567
Evaluation/Assessment Studies	354	608	157	402	332	294
Research Studies	459	461	644	691	396	718
Program Planning and Direction	791	1,032	1,196	1,633	775	1,361
Provincial Program (Federal Share)	364	865	688	744	376	460
Provincial Program (Provincial Share)	264	289	1,243	1,250	1,250	1,250
TOTAL	$9,342	$19,735	$28,468	$33,512	$32,753	$32,449
Source of Funds						
SEP Phase I	$7,878	$17,146	$24,735	$28,462	$26,911	$26,000
DFO* Contribution	1,200	2,300	2,500	3,800	4,592	5,199
Provincial Share	264	289	1,243	1,250	1,250	1,250
TOTAL	$9,342	$19,735	$28,478	$33,512	$32,753	$32,449
Phase II Program Development	—	—	—	—	$ 2,466	$ 1,496

* Department of Fisheries and Oceans.

Major Production Projects

Design and Construction

Project	**Amount**
Engineering Management	$1,266,300
Land DPW	324,200
Tenderfoot	230,000
Kitimat	5,195,900
Quesnel	10,500
Eagle	395,000
Inch	621,900
Chehalis	1,542,600
Glendale	128,700
Total	**$9,715,100**

Minor Production Projects

Project	**Amount**
Administration	$ 770,600
Stream Catalogue	7,800
PIP Support	43,500
CEDP Support	93,600
Stream Rehabilitation	13,600
Fishway Maintenance	7,700
Stream Clearance	19,700
McNab Creek	2,800
Louis Creek	10,100
Little Mountain Slough	3,900
Side-Channel Maintenance	7,500
Alouette River	41,300
Upper Paradise	21,800
Peach Creek	12,600
Hemming River	39,500
Vancouver River	20,200
Scott Cove	3,700
Sooke River	7,600
Copper River	36,400
Yukon Potholes	13,300
Sachs Creek	10,200
Read Creek	8,200
Finn	15,300
Total	**$1,210,900**

Pilot Studies

Project	**Amount**
Penny	$104,900
Kitsumkalum	111,900
Mathers	166,000
Total	**$382,800**

Facility Operations and Maintenance

Project	**Amount**
Enhancement Ops. Admin.	$ 864,400
Quesnel	513,400
Inch	400,700
Chilliwack	524,900
Chehalis	259,800
Tenderfoot	114,300
Jones River Channel	15,200
Birkenhead	85,300
Capilano	389,100
Big Qualicum	619,000
Little Qualicum	288,000
Puntledge	645,500
Chemainus	65,000
Tlupana Inlet	472,100
Nitinat	529,500
Quinsam River	681,400
Robertson Creek	628,000
Snootli Creek	376,100
Fulton River	278,700
Kitimat River	209,900
Pinkut River	290,600
Pallant Creek	394,900
Maintenance - General	382,800
Tlupana Maintenance	105,300
Nitinat Maintenance	76,000
Robertson Creek Maintenance	79,300
Kakweiken Maintenance	17,700
Bella Coola	38,500
Total	**$9,345,400**

Community Development

Project	Amount
Administration	$ 418,400
Water Sampling	4,300
Native Advisors	20,900
Tagging	4,600
Training Coordinators	29,100
Project Advisors	593,500
CDP Advisory Council	22,000
New Project Development	21,400
Chehalis	214,800
BCIT	106,500
Fraser River	74,900
Nanaimo	230,000
Cowichan	221,300
Sliammon	182,700
Sechelt	179,700
Thornton Creek	101,300
Port Renfrew	100,000
Nimpkish	300,200
Bella Bella	201,300
Kincolith	142,500
Kispiox	292,000
Masset	210,600
Total	**$3,672,000**

Public Involvement

Project	Amount
SETG Secretariat	$ 33,800
Administration	608,900
Public Information	181,500
Educator's Package	44,100
Public Participation Support	165,200
SETG Public Advisory	20,300
Kamloops Community Advisor (CA)	23,200
New Westminster CA 1	38,900
New Westminster CA 2	30,300
Sechelt CA	2,600
Nanaimo CA	45,600
Victoria CA	28,900
Port Hardy CA	22,000
Terrace CA	19,200
Queen Charlotte CA	14,000
Total	**$1,278,500**

Research

Project	Amount
Program Support	$ 18,800
Stress and Histophysiology	8,200
Hatchery Incubation	88,700
Time and Size Release	72,100
Chum Incubation	11,700
Smolt Requirements	12,100
Controlled Reproduction	68,300
Nutrition	61,100
Disease Control	4,800
Diagnostic Services	92,100
Stream Enhancement	11,700
Salmon Genetics	268,300
Total	**$717,900**

Lake Fertilization

Project	Amount
Program Management	$ 46,000
Juvenile Ecology	92,700
Adult Ecology	7,600
Survey and Research	45,300
Treatment	1,078,300
Monitoring	531,100
Total	**$1,801,000**

Manageability and Environmental Impact Studies

Project	Amount
Manageability Planning	$ 37,600
Salmon River	1,300
Upper Fraser	11,000
Upper Pitt	8,900
Shuswap Juvenile	1,000
Chilcotin River CWT	700
Fraser Chinook and Coho Report	2,100
Lower Fraser Coho CWT	3,300
Chilliwack River	400
Tete Jaune CWT	26,100
Fraser Mgmt. - Chilco	8,000
South Coast - Manageability	37,800
Data Base Completion	5,000
Kennedy Lake Test Fishing	4,300
South Coast Chum Stock ID	20,000
North Coast - Manageability	40,200
Kalum	8,700
Cumshewa Test Fishing	24,500
Cumshewa Chum Tag Report	5,000
Mark Recovery	321,300
Total	**$567,200**

Provincial Programs

Project	Amount
Headwater Stocking	$ 47,400
Steelhead Habitat Assessment	125,600
Chilco Fry Stocking	40,500
Thompson	58,000
Keogh Steelhead	58,300
Skeena Fry Stocking	130,400
Total	**$460,200**

Reconnaissance/Feasibility

Project	Amount
New Project Administration	$ 96,700
Water Quality	50,800
North Thompson	135,600
Eagle Island	110,600
Total	**$393,700**

Economics and Systems

Project	Amount
Direction	$149,400
Five Account Evaluation	4,300
Recreation Studies	300
Native Account	2,400
Industry Monitoring	400
Systems - General	31,400
EPIC Development	25,400
PM Development	2,800
EPIC and PM Operations	67,000
PRUNES Operations	1,300
CISFIN Operations	800
Software Purchasing/Development/ Maintenance	1,800
Training and Development	700
Catch Statistics - Economic	6,000
Catch Statistics - Biological	500
Total	**$294,500**

Program Planning and Direction

Project	**Amount**
Executive Director	$ 421,000
SEP Board	14,400
Native Trainees	47,600
Financial Administration	299,300
Common Services	36,300
Director Operations	9,200
Homing and Straying Assessment	2,800
Admin. - Biology	158,600
- Assessment	700
Annual Report	92,300
Method Review and Evaluation	4,000
Small Project Evaluation	50,000
PIP Evaluation	50,000
Fish Quality	55,700
Planning - Contract - Bio.	9,700
Fraser River GWG*	1,500
South Coast GWG	4,100
North Coast GWG	6,800
Yukon NBC GWG	5,000
Regional Planning	92,000
Total	**$1,361,000**

*Geographic Working Group.

C. *Salmonid Enhancement Board — List of Members*

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F. Publications

South Coast

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Glossary

Note: The definitions in this glossary are furnished by contributing writers and are relevant within the context of those writers' own sections.

activation: the process of initiating development in the fertilized egg after contact with water.

biomass: the weight or volume of biological material, e.g. - of zooplankton, phytoplankton, fish.

coelomic fluid: fluid in the body cavity.

cortisol: the principal cortical steroid hormone secreted by the interrenal tissue of salmon.

cryopreservation: storage of gametes (sperm and eggs) or embryos by freezing at very low temperatures.

double cropping: doubling the weight of fish produced per unit of space by moving the first group of fish out prematurely to another facility, (such as a rearing pen) or to a stream (by stocking fry) and rearing a second group of fish.

emigration: the downstream movement of juvenile fish.

female homogamety: existence of two similar sex chromosomes in the female.

fines: sand and silt measuring less than 0.1 cm or .01 m in diameter.

gabion: a wire basket filled with rocks and used for deflecting flows, protecting banks. Cylinder, wicker or woven metal bands are filled with earth for use in fortification for engineering.

glide area: a slow velocity, shallow stream section.

gonadotropin: the hormone which stimulates sexual maturation in salmon.

gynogenesis: a special form of parthenogenesis in which the egg is induced to develop without the contribution of chromosomes from the sperm.

histology: the study of tissue structure (microscopic anatomy).

hydraulic redd sampling: a method of collecting eggs and/or alevins from the gravel. Air and water are injected in the redd, using a small fire pump, and the eggs/alevins consequently float up and are collected in a net over the sample area.

hydrological survey: a survey or study of the waters of the earth, their occurrence, circulation and distribution, chemical and physical properties and reactions with the environment, including relation to living things.

imprinting: the process by which juvenile fish register environmental cues that enable them to return to their natal stream as adults.

interrenal: counterpart in fish to the adrenal cortex in higher vertebrates; the gland that produces the cortical steroids involved in the stress response.

kelt: a steelhead that has completed spawning.

lentic: "static water dwelling."

LHRH: a brain hormone which controls gonadotropin production and release.

limnetic: pertaining to the upper layer of the lake during the stratified period, i.e. May to October.

male heterogamety: existence of two dissimilar chromosomes in the male.

mesotrophic: having a moderate amount of dissolved nutrients; as in a moderately productive lake.

migration: the upstream movement of adults and occasionally juveniles (before smolting).

outplants: the juvenile fish transferred from a hatchery and released into their natal stream.

parthenogenesis: the development of an egg without fertilization.

radioimmunoassay: measurements of extremely low levels of biological substances, by displacement of labelled material bound to a specific antibody.

residuals: steelhead (usually male) that do not go to sea, but remain in the stream as residents.

satellite facility: a permanent central station for incubation and early rearing, serving several separate stocks. Sites on the "satellite" streams are used only during adult capture and juvenile imprinting through short-term rearing and may not require any permanent structures.

spermiation: final maturation of sperm in the testes prior to spawning, characterized by an increase in water content.

stripped groundwater: well water with its (usually) high nitrogen content removed; generally, the groundwater is stripped by passing it through an aeration tower.

teratogenicity: tending to cause developmental malformation.

topographical survey: a survey made to obtain data from which may be made a topographical map. The map indicates the relative positions and elevations of man-made and natural features of a place or region.

trophic levels: feeding or production levels in a biological community. For example, phytoplankton are primary producers, zooplankton are grazers, etc.

vibrio diseases: systemic bacterial infections. At least two separate species of bacteria belonging to the genus *Vibrio* are known to cause the disease. It affects only those fish which are held in salt water.

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British Columbia
Ministry of
Environment

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Edited and compiled by Glover Business Communications Ltd.

Layout by Bev Bowler

Word Processing of the text by Anne Jung, Maisie Louie